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OPEN-FILE REPORT 94-578

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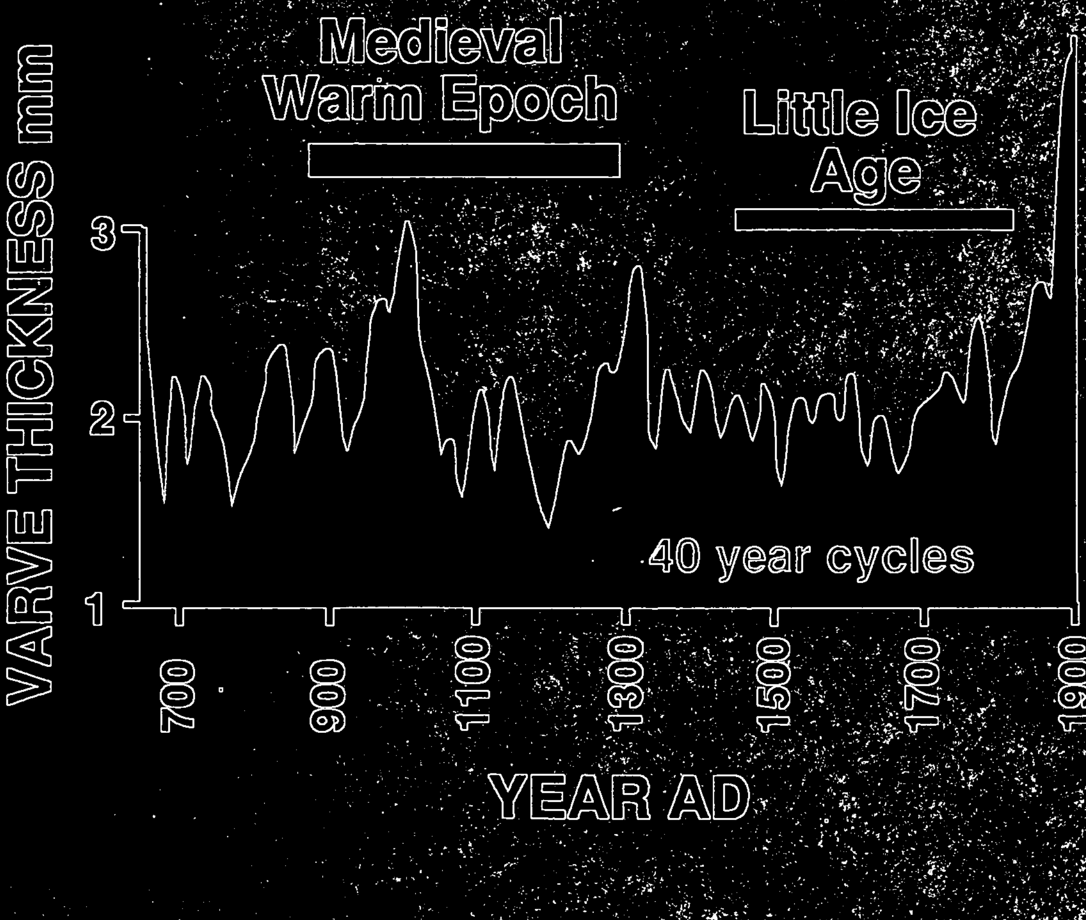

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ILLUSTRATIONS

The data presented in the Appendixes of this report are available through:

National Geophysical Data Center
NOAA, E/GC1, Dept. 891
325 Broadway
Boulder, CO 80303, U.S.A.

Phone: 303-497-6215
Fax: 303-497-6513
Internet: Info@mail.ngdc.noaa.gov
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A HIGH-RESOLUTION RECORD OF CLIMATIC CHANGE IN ELK LAKE, MINNESOTA FOR THE LAST 1500 YEARS

INTRODUCTION

Earlier investigations of varved sediments from Elk Lake, Minnesota (Fig. 1) based on integrated 50-year samples at 100-200-year intervals illustrated the sensitivity of Elk Lake to climatic change (Bradbury and Dean, 1993). Varve thickness measurements demonstrated the rapid (interannual) nature of climatic variation during parts of the Holocene (Dean and others, 1984; Bradbury and Dean, 1993). Studies of ostracodes (Forester and others, 1987), chironomids (Stark, 1976),and geochemical and mineral properties (Dean, 1993) showed that rapid (decadal to centennial), high amplitude changes in sediment components occured during the time interval of 10,000+ to 4,000 years ago. In contrast to these early and middle Holocene changes in sediment characteristics, the Elk Lake record for the past 4,000 years is more stable, but nevertheless shows lower amplitude variations in many sediment parameters over the last few millennia that testify to significant climatic changes at scales of human importance.

In this report we present the initial results of analyses of contiguous samples, each a composite of about five years, to document a high-resolution paleolimnological history of the past 1500 years in Elk Lake. These results chronicle past climatic changes in the north-central US throughout the period of time that encompasses the Little Ice Age, the Medieval Warm Period, distinctive episodes of reduced solar activity (the Maunder and Sporer Minima), and the impact of European settlement and exploitation of the region after AD 1890. The cyclicity of these changes suggests forcing mechanisms related to solar activity and its influence on the strength and direction of near surface wind fields at mid-latitudes in the Northern Hemisphere.Figure 1

SETTING

Geologic Setting:

Elk Lake (latitude 47°12' N., longitude 95°15' W.) is part of a complex drainage system that forms the headwaters of the Mississippi River in Itasca State Park, Clearwater County, northwestern Minnesota (Fig. 1). Elk Lake drains through a small stream, Chambers Creek, into Lake Itasca (Fig. 1) which has been designated as the headwaters of the Mississippi River.

The rolling topography of the Itasca Park region, with many low hills, lakes, and wetlands, developed on the Itasca moraine. The Itasca moraine formed when the Wadena ice lobe, with till containing Paleozoic carbonate debris acquired in southern Manitoba, arrived in the area about 20,000 years ago (Wright and others, 1973; Wright 1993). During the initial phase of glacier retreat, between 14,000 and 18,000 years ago, meltwater carved subglacial tunnel valleys into the landscape. Stagnant ice remained in deep depressions, protected from melting by a cover of drift from the receding glacier. A later ice advance between 12,000 and 14,000 years ago (the St. Louis sublobe of the Des Moines ice lobe) crossed the Red River Valley from west to east and deposited outwash with Cretaceous shale into some of the tunnel valleys that formed earlier (Wright, 1972).

Subsequent melting of the ice blocks during the final stages of the Wisconsin about 11,000 years ago produced a series of lakes and marshes roughly aligned north-south and complexly connected by stringers of coarse-clastic, tunnel-valley sediments. Lake Itasca, Elk Lake, and numerous small basins mark the complex pattern of these ancient drainage channels (Wright, 1972; Stark, 1976). There are many marshes, bogs, and smaller lakes within the drainage basin of Elk Lake. The lake is fed by numerous springs and four small streams that enter from the south and southwest.

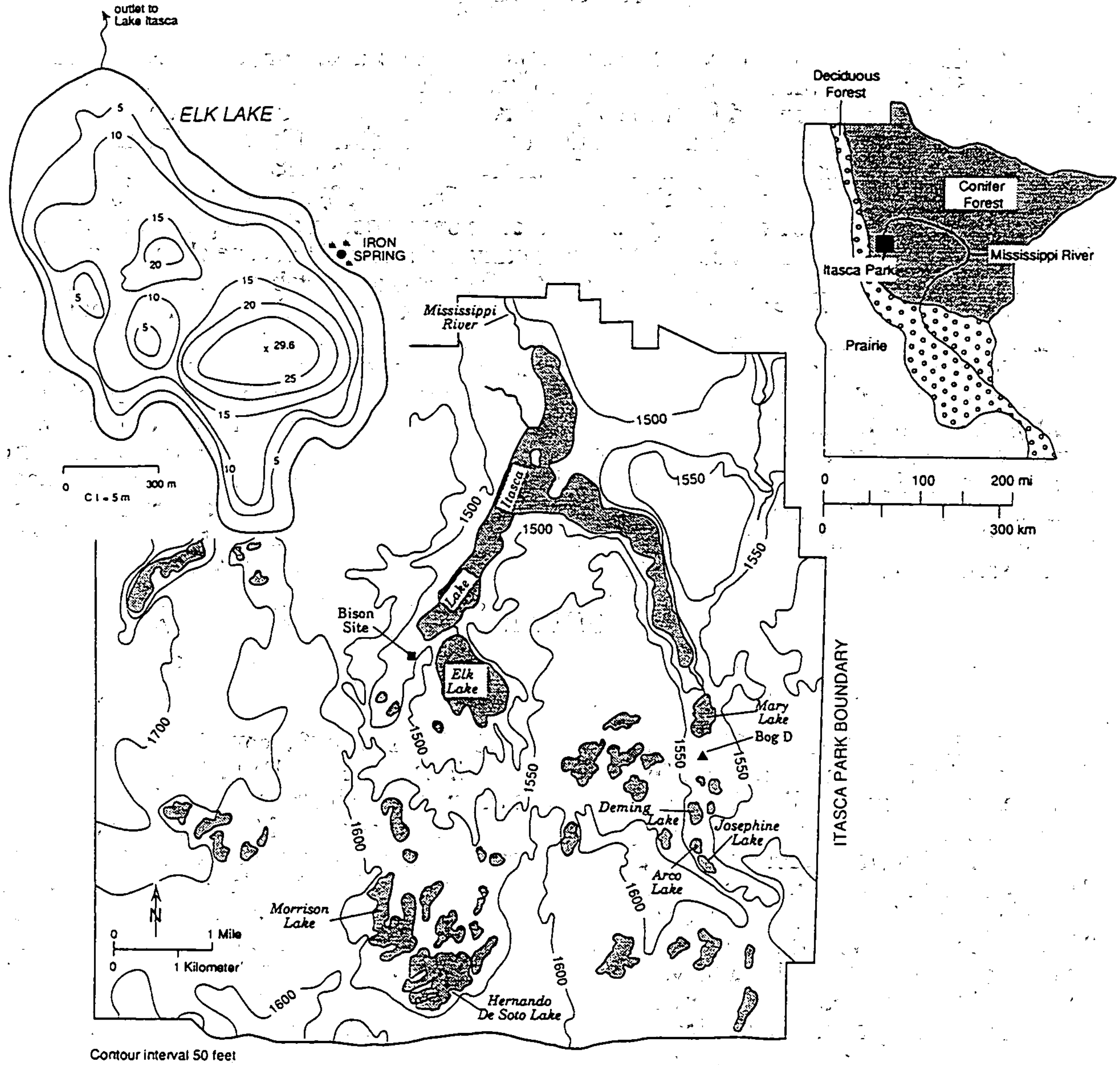


Figure 1. Maps of Minnesota, Itasca State Park, and Elk Lake showing the location of Elk Lake, general vegetation zones of Minnesota, bathymetry of Elk Lake, and location of the varved core in the deepest part of the lake (x).

Climatic Setting:

Elk Lake presently is situated in a pine-hardwood forest but is only 80 km east of the prairie-forest border (Fig. 1). During the more arid mid-Holocene, the present forest-prairie border (Fig. 1A) shifted eastward at least 100 km (Wright, 1976). As climate changed and the ice front withdrew from Minnesota, regional airstreams shifted and oscillated. The prairie/forest ecotone moved back and forth across Elk Lake, changing lake levels, altering the biota and geochemistry of the lake, and changing the vegetation and ground cover.

Elk Lake lies near the junction of three dominant air masses (Bradbury and others, 1993): (1) an arctic air stream that extends southward from Canada and reaches the north-central United States in winter; (2) a Pacific air wedge that follows the path of strongest westerlies as they enter western North America from the Pacific Ocean, losing moisture as it crosses the coastal and Rocky Mountain cordillera; and (3) a tropical air stream that brings warm, moist air northward from the Gulf of Mexico especially during the summer months (Bryson and Hare, 1974).

Depending on the season, the presence and interaction of these different air masses characterize the climate of northwestern Minnesota (Anderson and others, 1993a). The dry, warm Pacific air mass forms an eastward-pointing wedge that reaches the north-central United States in winter, and retreats northward into Canada in the summer. The main role of the Pacific airmass on the climate of the Elk Lake region occurs when it entrains and lifts moist Gulf air to produce heavy snowfall. The arctic air mass also prevails in the Elk Lake region during the winter, although outbreaks of arctic air do occur in the summer (Baldwin, 1973). Incursions of arctic air usually follow heavy snowfalls produced by the interaction of the westerlies and the Gulf Coast air creating sever blizzard conditions with deep snow drifts.

The warm, moist tropical Gulf air mass does not usually invade northern Minnesota during the winter, but during the summer, circulation around low-pressure systems moving from west to east across continental United States causes substantial northward flow of moist air from the Gulf of Mexico into the Elk Lake region. The contrast between the warm land in southwestern US and a cooler Pacific Ocean during the summer months (the southwest monsoon effect), and circulation around the west side of the Bermuda high-pressure system in the western North Atlantic enhances this northward flow of Gulf moisture. Interaction between this Gulf air with Arctic air flowing almost straight south to meet it produces thunder storms that provide the principal source of moisture for the Elk Lake region in the spring and summer.

Overall, the Elk Lake region has a continental climate with cold winters and warm to hot summers. The average seasonal temperatures in the Itasca Park area for the 30-year period from 1951 to 1980 are illustrated in Table 1.

TABLE 1. AVERAGE SEASONAL TEMPERATURES AT ITASCA STATE PARK

Mean annual temperature	3.0°C
Mean spring temperature	2.7°C
Mean summer temperature	17.9°C
Mean fall temperature	5.3°C
Mean winter temperature	-13.9°C

Values are for the period 1951 to 1980, and have been corrected for 0800 hour observation (from Baker and others, 1985).

From a limnological perspective, the seasonal progression of temperature and wind, generally associated with storms, are important in determining the span of the ice-free season, and the timing and amounts of nutrient fluxes into Elk Lake (Bradbury, 1988). Climatic observations coupled with sediment-trap collections between 1979 and 1984 (Nuhfer and others, 1993) provide important links between climate, water-column processes, and sediment components.

Most of the inorganic and organic components of the sediments that accumulated on the bottom of Elk Lake were produced in the lake (i.e. they are autochthonous). The dominant components are precipitated $CaCO_3$, biogenic opal from diatom remains, organic matter, and iron, mainly as iron oxyhydroxide and iron phosphate (Dean, 1993). Other minor, but environmentally sensitive, autochthonous components include dolomite, manganese oxy-hydroxide, and manganese carbonate (rhodochrosite). Allochthonous siliciclastic detrital material also is a minor component, but, because it enters the lake mainly as wind-borne material, it is an important climatic indicator. Variations in relative abundances of these sediment components faithfully recorded oscillations in regional climate as changes in the abundance and composition of the biota and changes in the composition and texture of the sediments. Because the sediments are varved, the timing of key events can be determined precisely. Equally important, the natural chronometer provided by the varves allows us to examine climatic variability across a wide band of climatic frequencies and examine climatic cycles with periods of a few years to several thousand years.

METHODS

Core Correlation and Varve Series Construction:

The varve chronology for the last 1500 years in Elk Lake is based on the following cores: 1. a "frozen finger" or box core (BC in Fig. 2) collected in 1978 (Anderson and others, 1993b); 2. two 1-m-long segments of a Livingston piston core (JA and JB in Fig. 2) also collected in 1978 (Anderson and others, 1993b; 3. two oriented Livingston piston cores taken for paleomagnetic work in 1983 and 1984, and referred to as EL83B-1 and EL84B, respectively (Sprowl, 1985; Sprowl and Banerjee, 1989). The varve chronology established for the 1978 box core starts at the base of the disturbed zone that resulted from logging activities around Elk Lake in AD 1903 when a dam was built to float logs from Elk Lake to Lake Itasca (Fig. 2; Anderson and others, 1993b; Bradbury and Dieterich-Rurup, 1993). Distinctive diatoms of the genus *Aulacoseira* begin to increase two centimeters and 4 varves below the disturbed zone in the box core which provides a dated stratigraphic marker that can be transferred to the unphotographed part of core EL84B where the same *Aulacoseira* increase occurs at a depth of 28.5 cm (Fig. 2). The *Aulacoseira* horizon is, therefore, dated as AD 1899.

Core EL84B begins at the sediment/water interface, and the core top is assumed to date AD 1984. Therefore, 85 years are assigned to the interval from the surface to the *Aulacoseira* horizon (0 to 28.5 cm) in this core (Fig. 2), and the time is apportioned equally among the samples collected in this interval. The photographic record of EL84B begins at 40 cm depth with two distinctive white varves referred to as the "double white" horizon (DW in Fig. 2) at a depth of 40.5 cm. The same distinctive varves are found in the 1978 box core at a depth of 41 cm, 31 varves below the base of the disturbed zone (AD 1903) or 27 varves below the *Aulacoseira* horizon. This chronology allows the DW horizon to be dated as AD 1872, or 112 varve years before present (yBP), in which the "present" is 1984. Consequently, 27 years are assigned to the 12-cm interval between 28.5 cm (*Aulacoseira* horizon) and 40.5 cm (DW horizon) in EL84B (Fig. 2), and the time is apportioned equally among the samples collected in this interval.

Beginning with the DW horizon, the varve chronology for EL84B has been established by counting varves on enlarged photographs. Therefore, the first varve measured is dated at 113 yBP (Appendix I). Other distinctive varves (layers A-E, Fig. 2) have been identified (Sprowl, 1993) that assist correlation between EL84B and EL83B-1 as well as to the Box Core and piston cores JA and JB taken in 1978. The top of core EL83B-1 is 100 cm below the sediment/water interface (Sprowl, 1985), and layer "B" occurs 5 cm below the top of the core, or 105 cm below the sediment/water interface. Layer "B" occurs 97 cm below the sediment-water interface in core

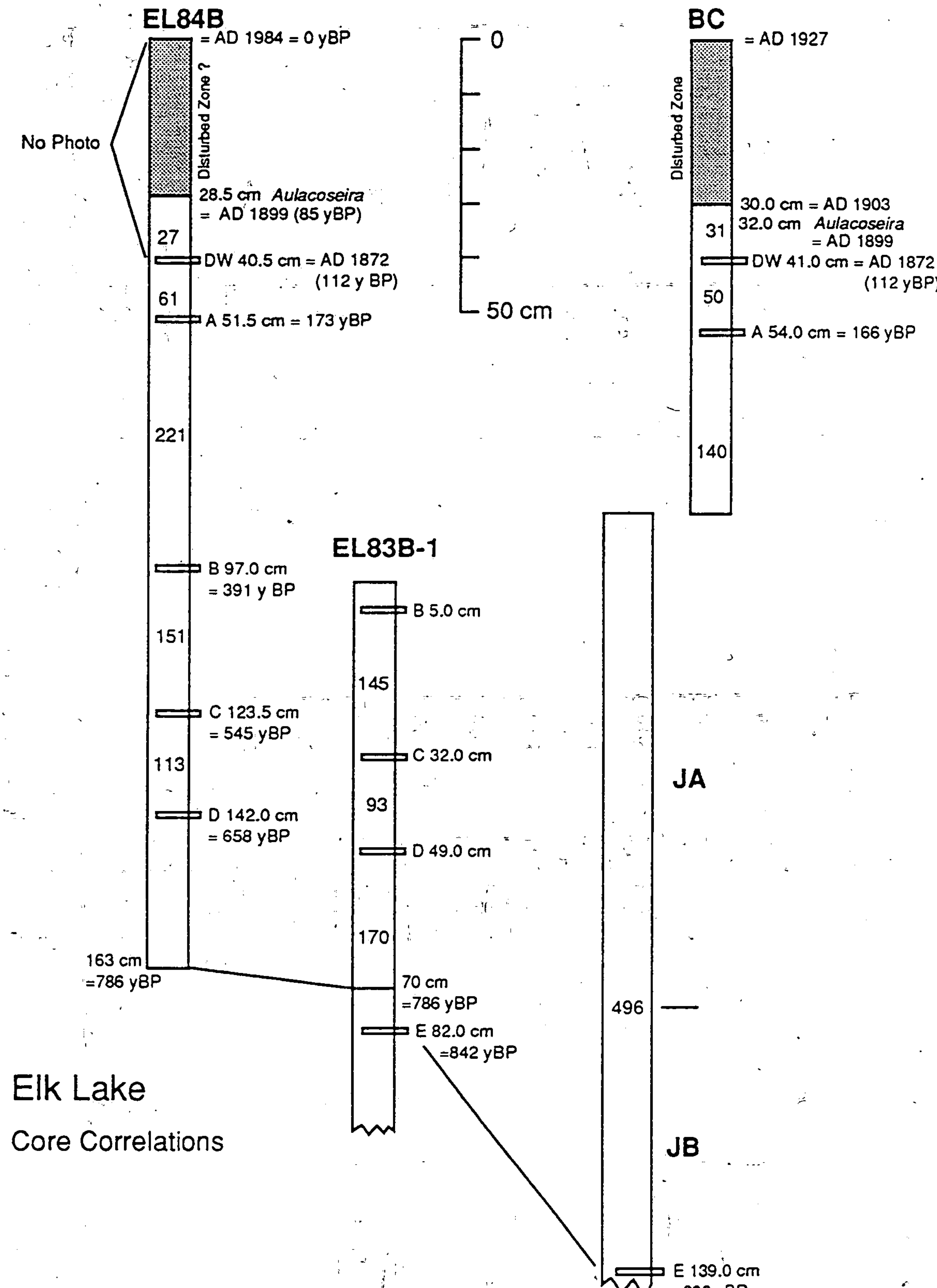


Figure 2. Diagram showing ages and correlation of distinctive marker layers in cores from the upper 2 m of Elk Lake. Cores BC (box core) and JA-JB (piston cores) were taken in the winter of 1978, and piston cores EL83B-1 and EL84B during the winters of 1983 and 1984,respectively. The numbers between the marker layers are varve counts.

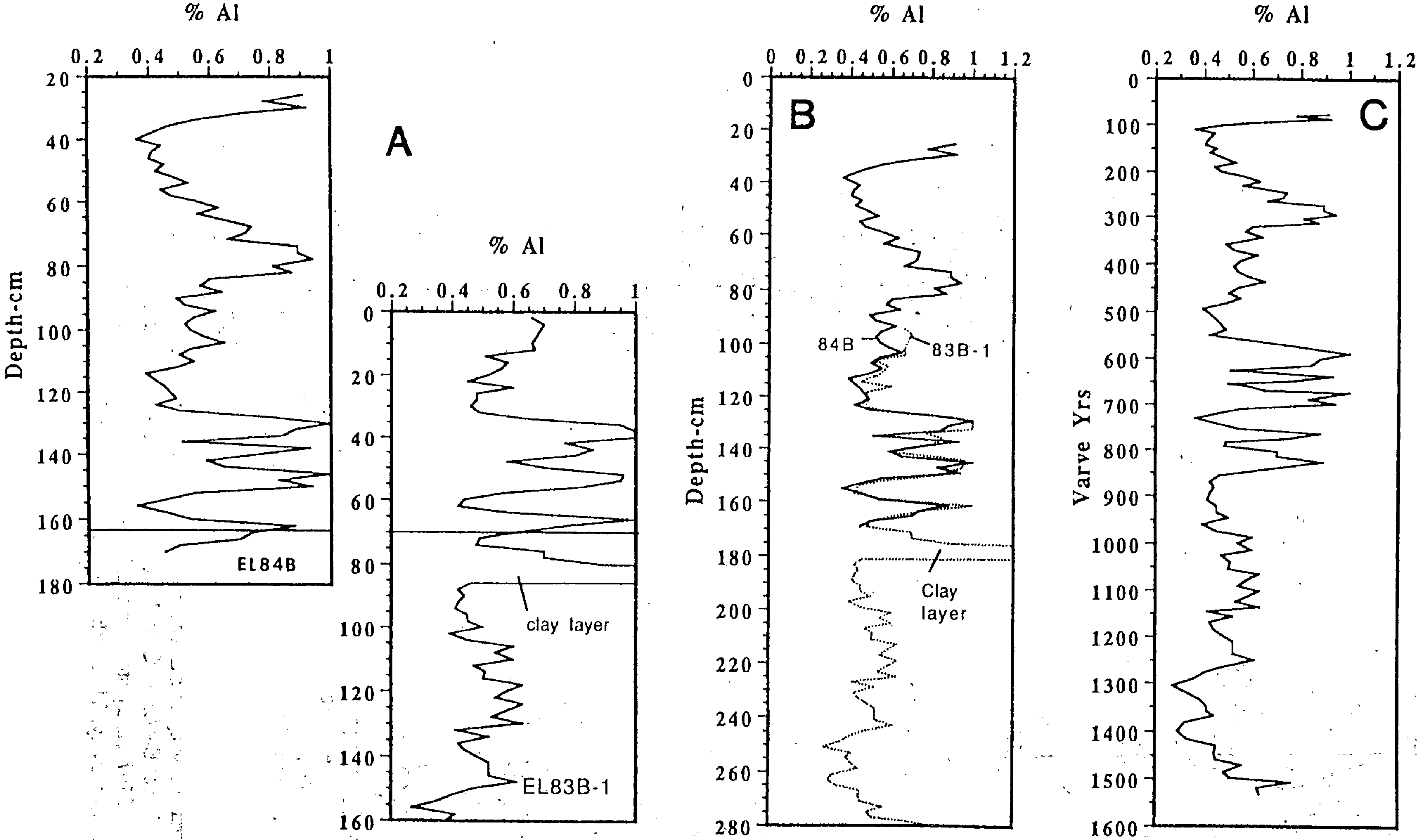


Figure 3. Profiles of % Al versus (A) depth in core for cores EL84B and EL83B-1 showing the point of cross-over between the two cores at 163 cm and 70 cm in the respective cores; (B) depth below the sediment/water interface as defined by the top of EL84B, with the data for EL84B shown as a dotted line and that for EL83B-1 as a solid line; (C) varve years with data for EL83B-1 removed above 163 cm (788 varve years). The clay layer is a distinctive clay-rich horizon (turbidite?) that corresponds to layer "E" in Figure 2.

EL84B at 391 yBP. Any differences in depths relative to the sediment/water interface between EL84B and EL83B-1, or any other core taken from different places in the "deep hole" of Elk Lake, are due mainly to a combination of problems associated with: 1. bottom topography; 2. defining the sediment/water interface measured relative to the surface of the lake, which was frozen during coring operations, through a 30 -m water column, and into flocculent mud, and 3. differential compaction during coring and subsequent core handling. The varying number of varves counted between marker layers in different cores (Fig. 2) reflects the variability of varve expression between cores, and provides an estimate of the precision of varve counting. (see also Sprowl, 1993). For example, the estimated age of layer "E", a 1-cm thick layer of clay, from varve counts on photographs of the box core and piston cores JA and JB taken in 1978 is 802 yBP (Fig. 2). The estimated age of layer "E" based on improved varve counting techniques for cores EL84B and EL83B-1 is 842 yBP, a difference of 5%.

The cross-over between EL84B and EL83B-1 was made at depths of 163 and 70 cm below the tops of the respective cores where distinctive varves can be exactly correlated between the cores (Fig. 2). This corresponds to a varve chronology of 786 yBP. This correlation is shown in plots for %Al in Figure 3. Figure 3A shows plots of % Al in both cores with the 163 cm level in EL84B matched to the 70 cm level in EL83B-1 as indicated by varve correlation (Fig. 2).
Figure 3B is a composite plot of %Al versus depth below the sediment/water interface as defined by the EL84B core. The resulting composite varve chronology for the EL84B and EL83B-1 sequence amounts to 1527 varve years.(AD 457 to AD 1984) (Appendix I). Figure 3C shows the composite plot of % Al versus varve years with the overlapping data from EL83B-1 removed. In Figure 3C, note that the "clay layer", which corresponds to layer "E" in Figure 2, also has been removed. The '"clay layer" is assumed to be an instantaneous time event, probably a turbidite, so it's removal does not affect the time scale. Although the event resulted in a layer of clay only 1-cm thick, it affected the chemical composition of the sediment for several samples or a total thickness of about 5 cm.

Grey-Scale Densitometry, Varve Measuring and Counting:

Enlarged photographs of cores EL83B-1 and EL84B were scanned into a MacIntosh computer and the captured images saved as "___.TIFF" files using Adobe Photoshop software. The "___TIFF" files were then read into Image 1.49, a public domain image analysis software package that is produced by the National Institutes of Health and examined at a resolution of 125 pixels per linear centimeter (1cm on screen = 125 pixels). The boundary of each annual grouping of laminations was identified and marked on the digitized image using the line tool. Interpretation of varve units was aided through use of the Image 1.49 color spectrum. Varve units were consecutively numbered on the screen image and the interpreted image saved as a permanent record (Fig. 4). Varve numbers were also recorded on profiles of gray-scale density along a line 10-pixels wide drawn through lines marking varve boundaries on the interpreted image.

Gray-scale density for each varve unit was determined with the selection tool by centering a selected area of 625 pixels (25 x 25 pixels, 2mm x 2mm, a width that is slightly larger than the average thickness of a varve), at the midpoint of each annual grouping. Gray-scale density values were measured on a scale ranging from 0 (white) to 255 (black). Use of the midpoint of a varve for thickness and gray-scale measurements had the effect of slightly smoothing adjacent gray-scale values. However, gray-scale profiles constructed with single measurements, as described above, and plots of profiles along a line 10-pixels wide made with the profiling tool resolve similar changes in gray-scale density.

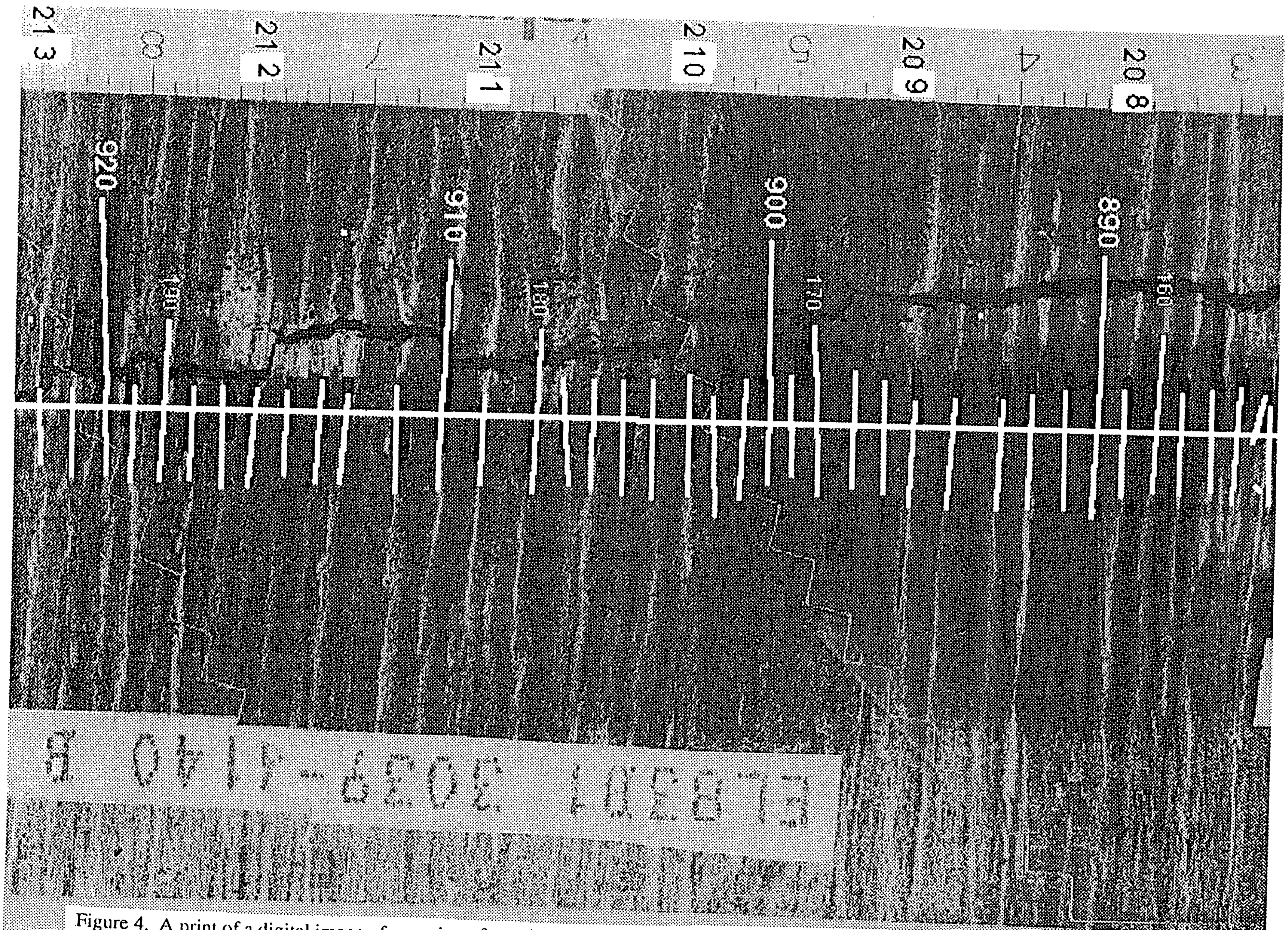


Figure 4. A print of a digital image of a portion of core EL83B-1 showing interpreted positions of boundaries between individual varve couplets. Graduations on the scale at the left are in millimeters.

The thickness of each annual grouping was determined by converting the number of pixels between consecutive varve midpoint measurements to millimeters. Measurement of varve thickness at the mid-point of annual groupings had the effect of shifting measurement values by a half varve unit but this procedure allowed determination of both thickness and gray scale with a single measurement. Thickness and gray scale measurement values were saved in Image 1.49 and exported to an Excel spreadsheet.

A total of 1415 varve units was measured (Appendix I). The jumpover from core EL84B to Core El83B-1 was made between varve numbers 674 and 675. For core EL84B, three photographic frames were printed at slightly different photo densities and small adjustments, based on the gray-scale density of overlapping images were made in order to achieve a nearly constant background density. No corrective adjustments were necessary for Core EL 83B-1.

Sampling:

Samples of varved sediment from the 28-m profundal hole of Elk Lake (Fig. 1) originated as contiguous, paired magnetic samples in 2 cm^3 plastic boxes cut from 5-cm diameter cores taken in 1983 and 1984 (Sprowl, 1985; Sprowl and Banerjee, 1989). A continuous record of the past 1500 years was provided by the upper 163 cm of core EL84B, which intersected the sediment water interface, and the lower 117 cm of core EL83B-1. The cores were correlated by distinctive varves or groups of varves and by overlapping geochemical and diatom analyses.

The sample boxes were numbered consecutively in 2-cm increments down the lengths of the cores. After cutting paired magnetic samples from the center of the cores (Fig. 3; Sprowl, 1985), the remaining two sides of the cores were scraped clean and then sequentially photographed alongside a 15-cm metric scale. The scale was placed to the left of each upward-oriented core side, with the result that the scale was located on the proximal edge of the left core side (B) and the distal edge of the right core side (A) (Fig. 3). Because varves in the core are variably inclined relative to the core axis, the distal/proximal scale placement does not always give identical stratigraphic measurements for distinctive laminations. In addition, some core shrinkage occurred due to desiccation between sampling and photography. In the case of core EL83B-1, the sample boxes cover a slightly longer (2 cm) stratigraphic distance than the subsequent core side photographs. This problem and the non-equivalent scale placement introduces some small error in sample placement within the varve-thickness and grey-scale density chronologies that were measured on digital images of the photographs (Fig. 4).

For analysis of organic- and carbonate-carbon, carbon and oxygen isotopes, and mineralogy, the upper 2-cm sample (labeled A) was cut horizontally into two 1-cm halves each representing half of the stratigraphic thickness of the interval (Fig. 3). The lower 2-cm sample (B) was first split in half vertically into two pieces. One of these two pieces was then cut in half horizontally to provide two diatom samples representing the upper and lower halves of the 2-cm stratigraphic interval. The remaining piece (representing a stratigraphic interval of 2 cm) was analyzed for major and trace element geochemistry and for biogenic opal (Fig. 3).

Geochemical and Mineralogical Analyses:

Total carbon and inorganic (carbonate) carbon were determined using a coulometer on splits of powdered 1-cm samples of sediment (Engleman and others, 1985). The carbonate in the untreated whole sample was acidified with perchloric acid to liberate CO_2, which was titrated in the coulometer cell to measure carbonate carbon. Total carbon was measured by titrating CO_2 liberated during sample combustion at 1050° C in a stream of oxygen. The technique has a precision of better than ± 0.5% for both carbonate and total carbon. Organic carbon was calculated

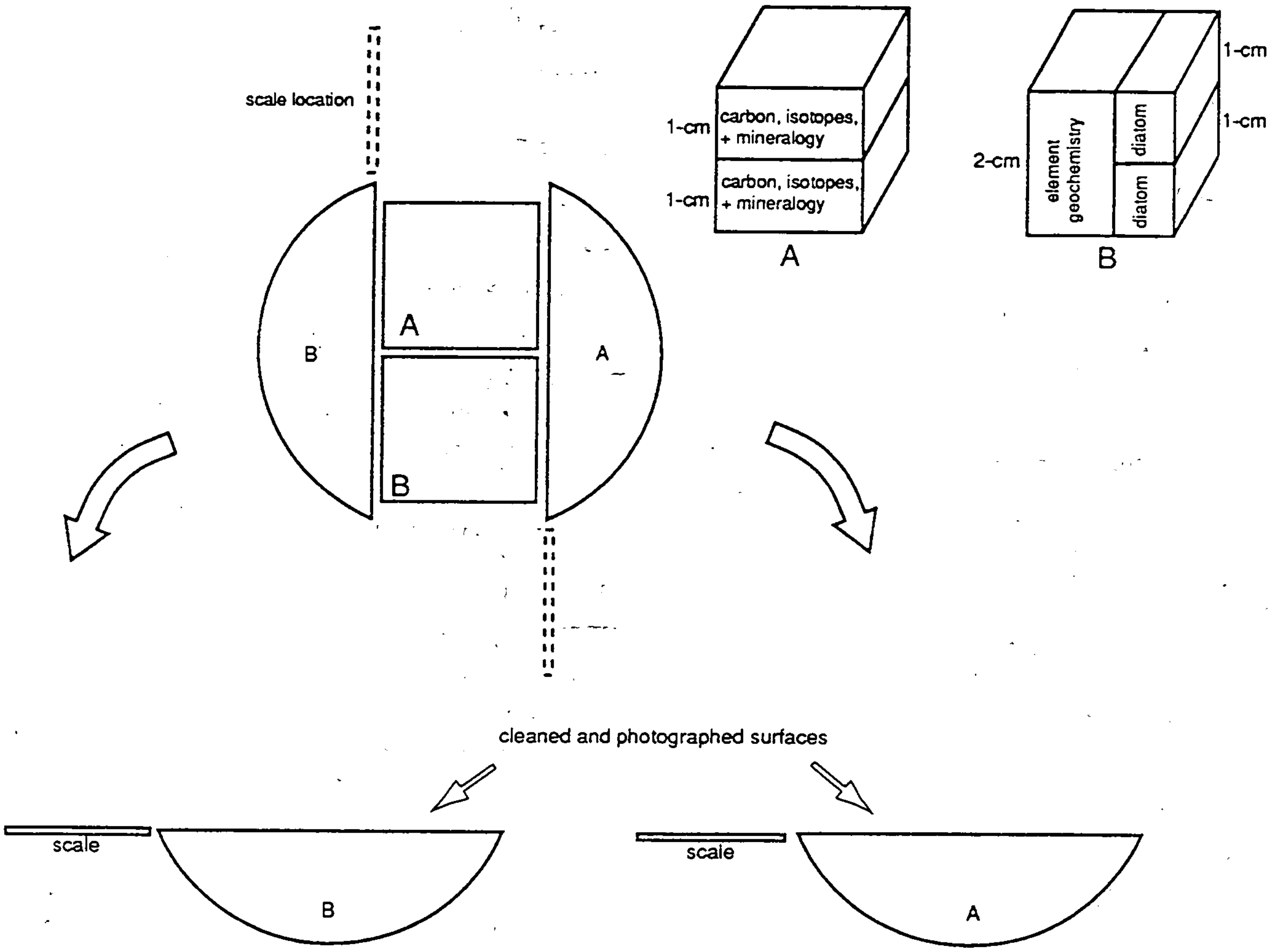


Figure 5. Diagram showing relationship of paired 2-cm^3 plastic paleomagnetic sample boxes (A and B) to a core cross section and the resulting core sides (L and R) that were cleaned and photographed against metric scales placed along the left-hand edge of the longitudinal core sides. Three-dimensional views of a pair of 2-cm^3 samples (A and B) illustrating how samples were collected for analyses of total and carbonate carbon, X-ray diffraction mineralogy, carbon and isotope geochemistry, element geochemistry, and diatoms.

as the difference between total and carbonate carbon.

Semi-quantitative estimates of mineral contents of powdered bulk 1-cm (5-yr) samples were determined by standard X-ray diffraction techniques (e.g. Moore and Reynolds, 1989). An aliquot of powdered sample was packed into an aluminum holder and scanned from 2° to 60° 2θ at 2° 2θ/min using Ni-filtered, Cu-Kα radiation at 45 kv, 30 ma on a Phillips XRG3100 diffractometer equipped with a curved-crystal graphite monochrometer.

Splits of powdered 2-cm (10-yr) samples of sediment were analyzed for 40 major, minor, and trace elements by inductively coupled, argon-plasma emission spectrometry (ICP: Baedecker, 1987). Concentrations of 24 elements (Al, Ca, Fe, K, Mg, Na, P, Ti, Mn As, Ba, Ce, Co, Cr, Cu, La, Li, Mo, Ni, Pb, Sr, V, and Zn) were above detection limits in at least one sample. The following elements (with their detection limits in parts per million in parentheses) were looked for in all samples but not detected an any sample: Ag (2), Au (8), Bi (10), Cd (2), Eu (2), Ho (4), Nb (4), Nd (4), Sc (2), Sn (5), Ta (40), Th (4), Y (2), and Yb (1).

Diatom Analyses:

Diatom samples 0.66 cm^3 (1.0 x 2.0 x 0.33 cm) were placed in vials and covered with distilled water. A small sub-sample of water-saturated sediment (about 0.3 cm^3 after centrifugation) was placed in a 15 ml centrifuge tube and digested in about 3 ml of concentrated HNO_3 at 100° C for 1/2 hour in a hot water bath. This digestion removes carbonates and labile organic compounds, but leaves diatoms, chrysophyte stomatocysts and scales, opal phytoliths, siliceous clastic particles, and some carbonized plant fragments intact. After digestion and solute removal by centrifugation and decantation, a known aliquot of diluted, suspended residue was settled onto an 18 mm diameter coverslip, dried, and subsequently mounted in a refractive (n = 1.6) medium (e.g. Battarbee, 1973). Because closely similar volumes of diatom residue are mounted on each coverslip, the number of diatoms enumerated along a standardized microscope transect gives an approximation of diatom concentration (diatoms/mm of transect) in each sample (Bradbury and Dieterich-Rurup, 1993). About 400 diatoms were counted from each level or until two 18-mm transects were examined at 1000 x magnification. Fragments of carbonized plant material, chrysophyte stomatocysts and scales, and phytoliths were enumerated separately from the diatom counts.

RESULTS

Varve Time Series and Gray-Scale Density:

The results of varve-thickness measurements are given in Appendix I, and plotted as a varve-thickness time series in Figure 6. The results of average gray-scale measurements on each varve are given in Appendix I, and plotted as a gray-scale time series in Figure 7.

Plots of both varve thickness and gray-scale density reveal quasi-periodic patterns of oscillation that probably reflect responses by the lacustrine system to changes in climatic variables at different time scales. For example, a plot of varve thickness with 2% weighted smoothing (Fig. 8) has an average varve thickness of about 1.6 mm, reveals a long-term trend toward thicker varves with decreasing age, shows several long oscillations of 500 and ~200-300 years, and also displays about 27 to 30 prominent oscillations in varve thickness with an average period between 40-50 years. This 40-50 year cycle period is well developed between 200 and 700 varve years, and plots of measured values (Fig. 9) and of 4% weighted values (Fig. 10) of varve thickness for this time interval show cycles in varve thickness with amplitudes of up to 1.0 mm.

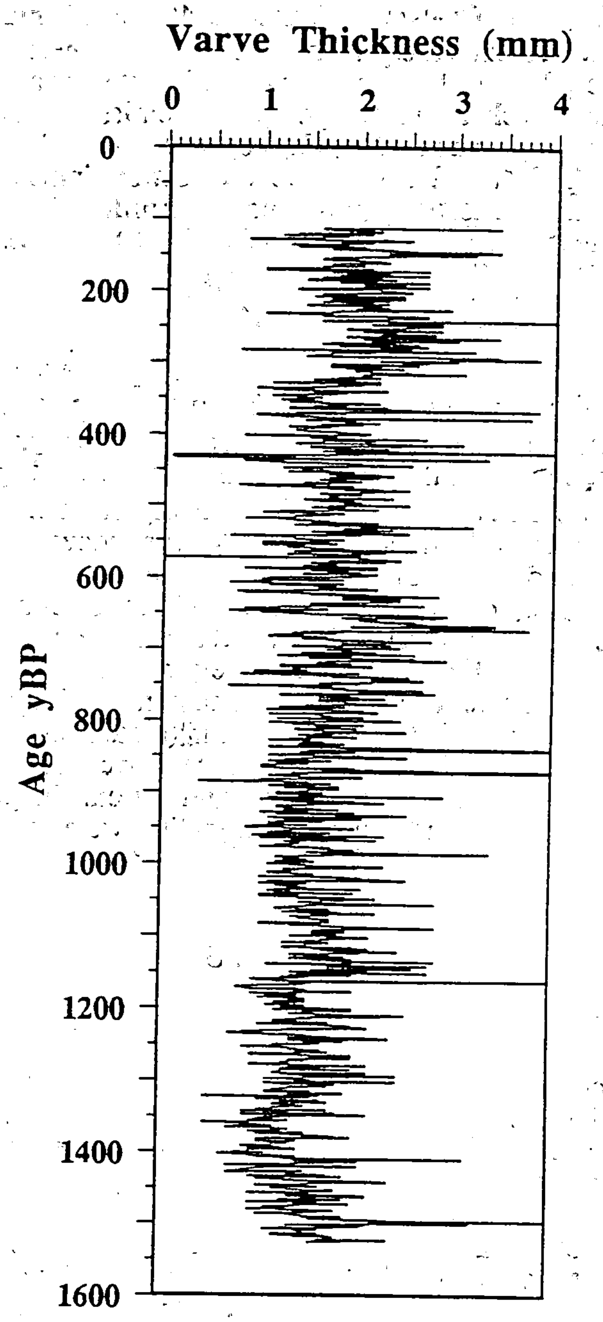


Figure 6. Profile of varve thickness in millimeters for cores EL84B and EL83B-1.

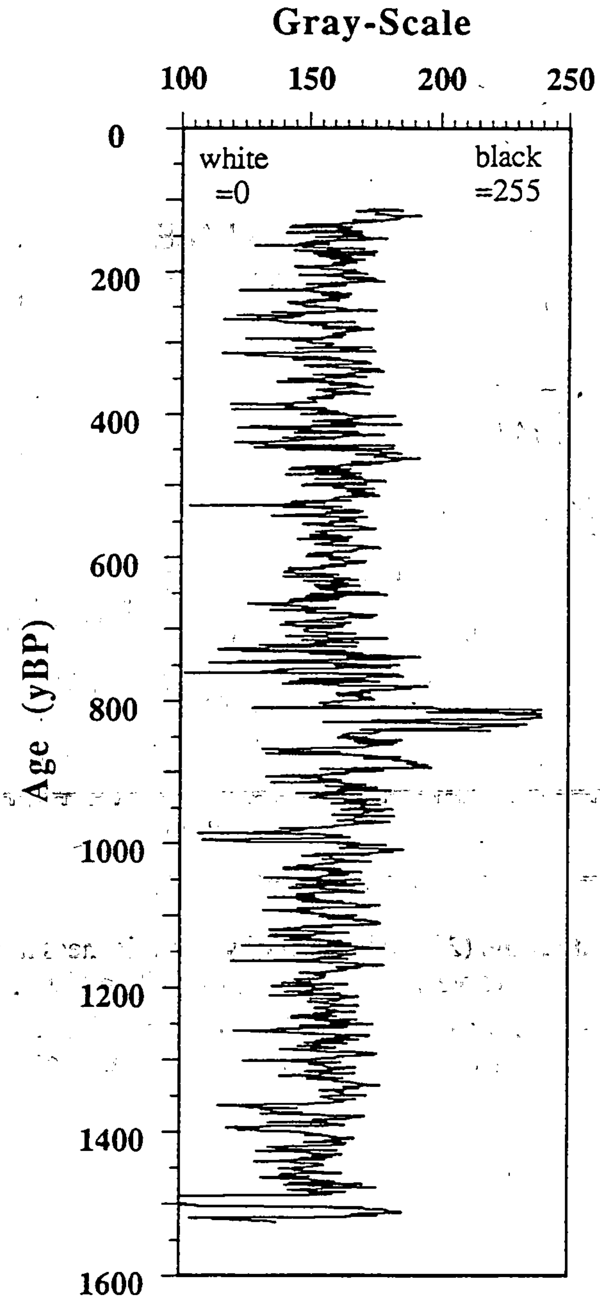


Figure 7. Profile of average gray-scale density versus varve years for cores EL84B and EL83B-1.

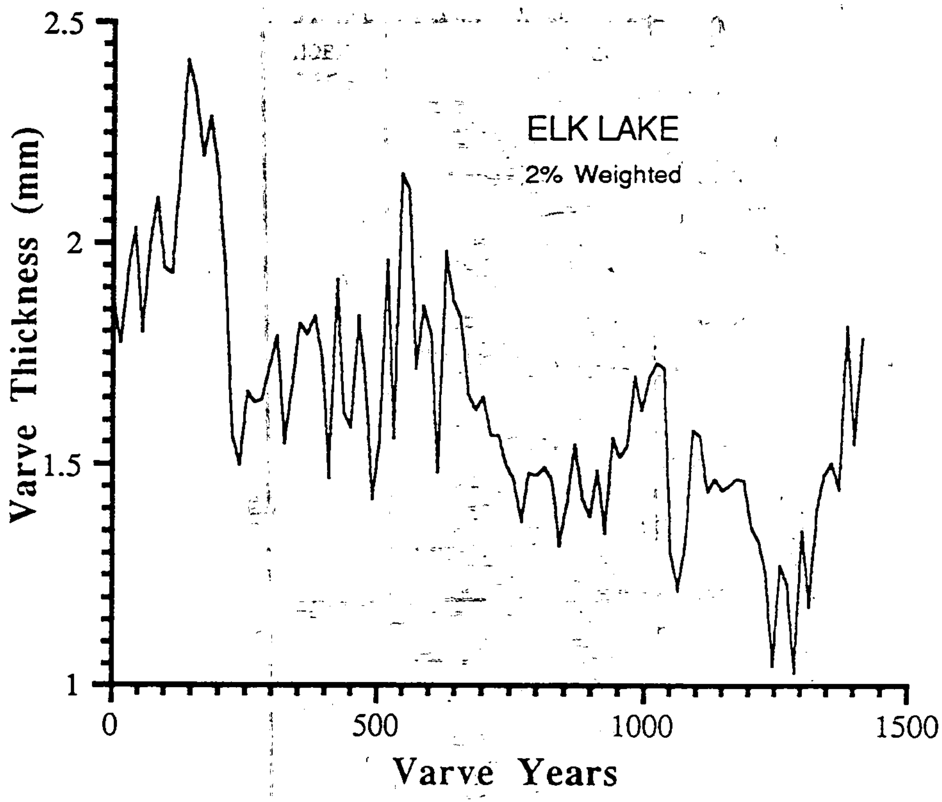


Figure 8. Smoothed profile (2% weighted) of varve thickness in millimeters versus varve years for cores EL84B and EL83B-1.

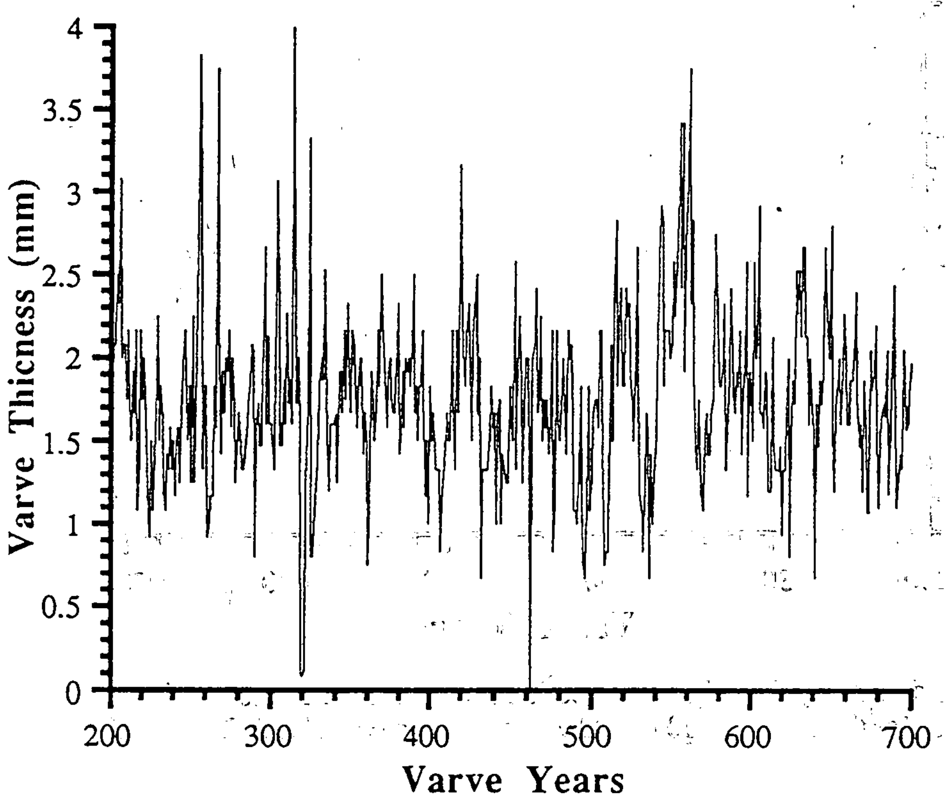


Figure 9. Profile of varve thickness in millimeters versus varve years for the interval 200 to 700 varve years in cores EL84B and EL83B-1

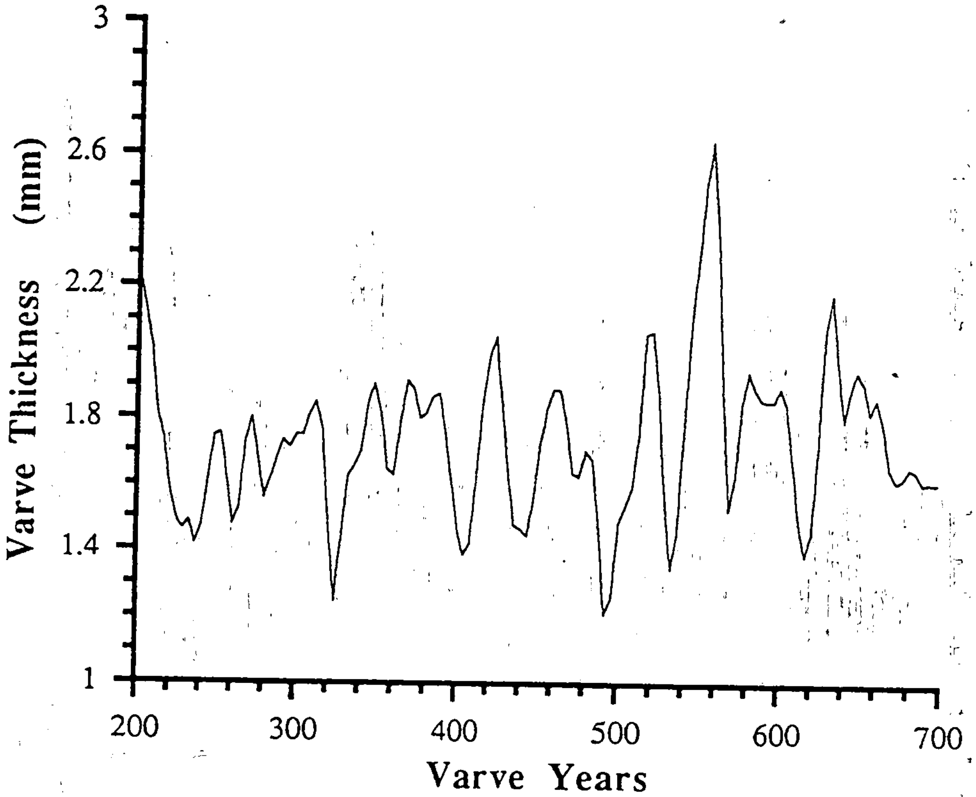


Figure 10. Smoothed-profile (4% weighted smoothing) of varve thickness in millimeters versus varve thickness for the interval 400 to 700 varve years in cores EL84B and EL83B-1.

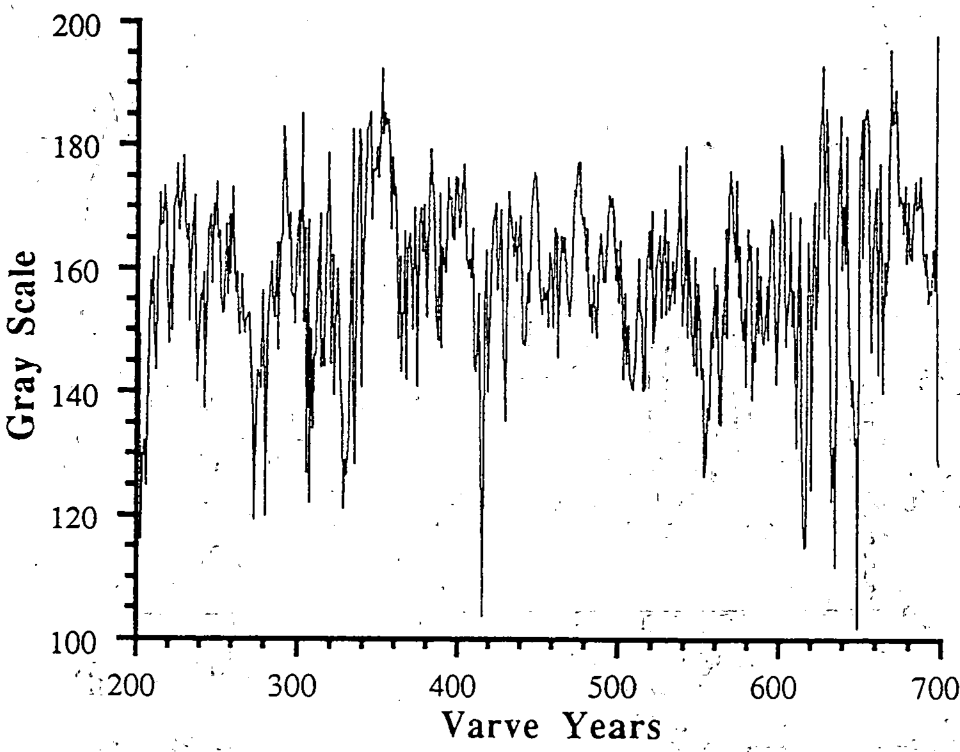


Figure 11. Profile of gray-scale density versus varve years for the interval 200 to 700 varve years in cores EL84B and EL83B-1.

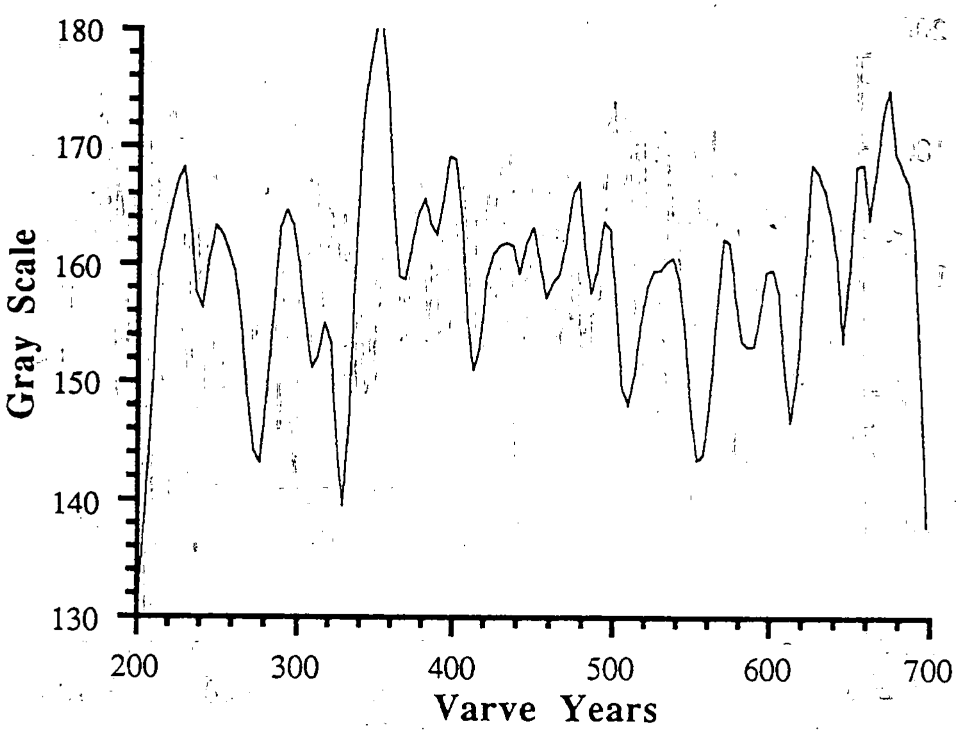


Figure 12. Smoothed profile (4% weighted smoothing) of gray-scale density versus varve years for the interval 400 to 700 varve years in cores EL84B and EL83B-1.

Plots of raw and smoothed gray-scale density values of the interval from 200 to 700 varve years (Figs. 11 and 12) reveal a similar pattern of 40-50 year oscillations but with no obvious relationship between values for varve thickness and gray-scale density. Absence of a clear association between varve thickness and gray-scale density is not unexpected, owing to complex changes in varve composition involving many components during the last 1500 years of Elk Lake history. If the Elk Lake varves were composed of simple binary couplets of dark-colored winter clay/organic laminae and light-colored summer carbonate laminae then we might expect a relationship between varve thickness and gray-scale density, with varve thickness and gray-scale density reflecting mainly changes in amount of carbonate preserved. However, the additions of annual cycles of other components, mainly iron, manganese, diatoms, complicates the Elk Lake varve interpretation (Anderson, 1993).

Organic Carbon and $CaCO_3$:

The results of measurements of total and inorganic carbon, and organic carbon (OC) by difference, are given in Appendix II, and plotted versus varve years in Figure 13. To obtain an estimate of the amount of total organic matter (most commonly taken as the loss on ignition, LOI, at 550°C; Dean, 1974), multiply the percent OC by about 2.5 (see relationships between % OC and LOI for surface sediments from Minnesota lakes in Dean, 1974, and for Holocene sediments from Elk Lake in Dean, 1993).

Sediment trap studies in Elk Lake (Nuhfer and others, 1993) showed that most of the organic matter that reaches the deeper parts of the lake is sedimented in the spring (April to early May) and fall (late October and November) indicating that most of the organic matter that reaches the profundal sediments of Elk Lake comes from populations of spring- and fall-blooming diatoms that settle rapidly and escape oxidation in the epilimnion. The other main phytoplankton populations are cyanobacteria (blue-green algae) that bloom during the summer. Cyanobacteria tend to remain floating in the epilimnion and (or) become washed up on shore so that much, if not most, of the organic matter derived from cyanobacteria is oxidized before reaching the hypolimnion. Consequently, although the cyanobacteria are important for processes operating during the summer months in the epilimnion and hypolimnion (e.g. carbonate production and dissolution; see discussion below), they are less important than the diatoms in contributing to the ultimate accumulation of OC in the profundal sediments.

The OC content of Elk Lake sediments almost doubled from <5% to >9% (Fig. 13) between 1500 years ago and 1350 years ago, the period of highest diatom productivity during the last 1550 years in Elk Lake (see diatom discussion below) The concentration of OC remains relatively constant from 1350 years ago to 200 years ago, with an average of about 6.5% and cyclic variations on either side of this average of several percent. The OC concentration increased markedly over the last 250 years from about 6% to more than 10% in modern sediments. This recent increase in OC concentration is the culmination of a long-term increase in OC from <4% 4000 years ago (Dean, 1993), reflecting the increase in moisture, development of mixed conifer forests, and consequent decline in detrital sedimentation. The increase over the last 100 years to OC concentrations that are higher than any during the last 1550 years, and, in fact, higher that any OC concentrations in the entire Holocene section in Elk Lake (Dean, 1993), probably is due to human disturbance, especially logging during the late 1800s and early 1900s.

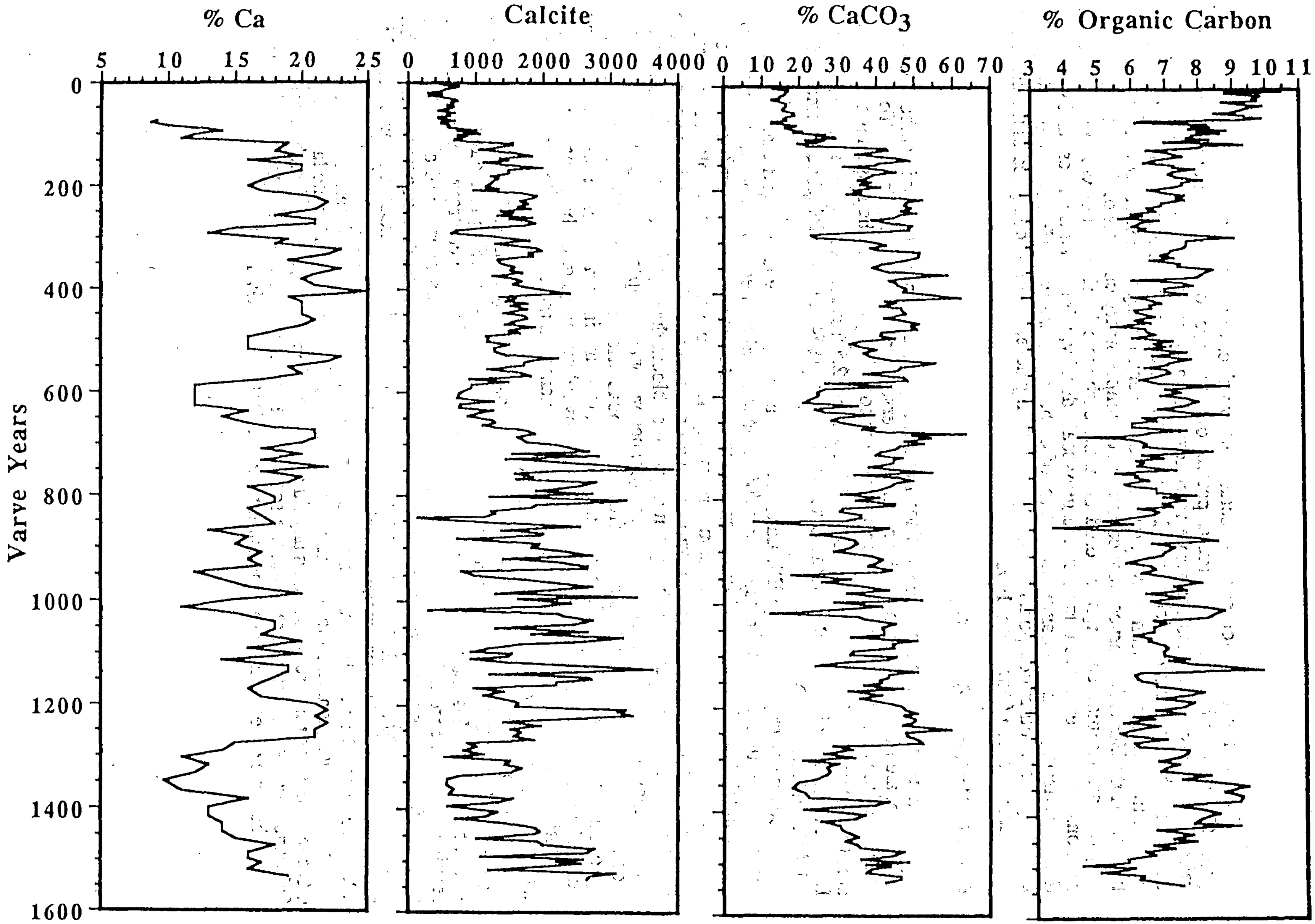


Figure 13. Profiles of percent calcium, X-ray diffraction calcite peak height, percent $CaCO_3$, and percent organic carbon versus varve years for cores EL84B and EL83B-1.

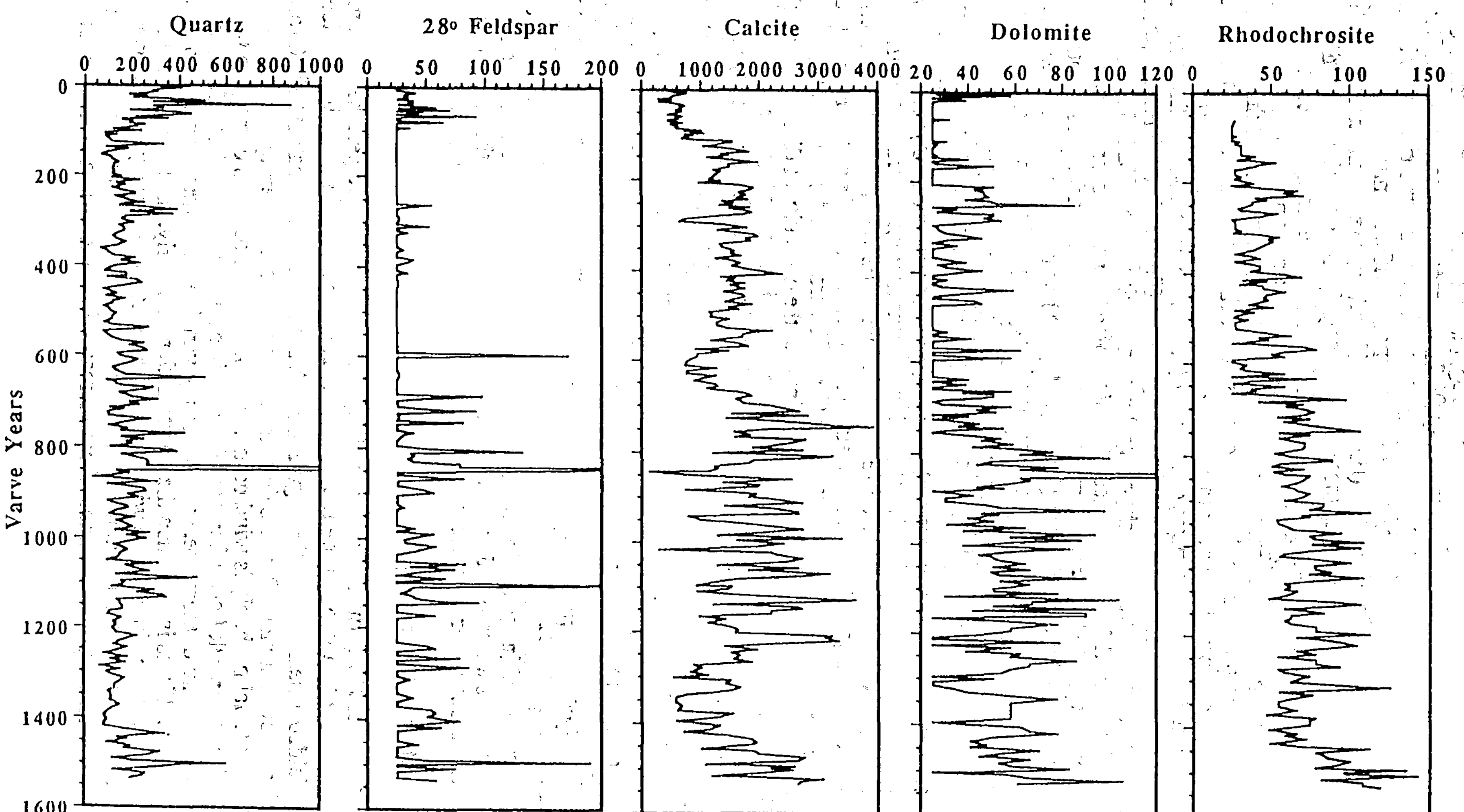


Figure 14. Profiles of concentrations (expressed as relative X-ray diffraction peak heights in units of detector counts) of quartz, feldspar, calcite, dolomite, and rhodochrosite versus varve years for cores EL84B and EL83B-1.

To obtain an estimate of the amount of carbonate as $CaCO_3$ in the sediment, we assumed that all of the inorganic carbon is present as $CaCO_3$, and calculated the percentage of $CaCO_3$ by dividing the percentage of inorganic carbon by 0.12, the fraction of carbon in $CaCO_3$ (Fig. 13). The assumption that all of the carbonate is present as $CaCO_3$ is not strictly true because X-ray diffraction analyses (discussed next) show minor amounts of dolomite (50% $CaCO_3$ and 50% $MgCO_3$) and rhodochrosite ($MnCO_3$) (Fig. 14). However, the abundances of dolomite and rhodochrosite are very small relative to that of calcite, as judged by relative X-ray diffraction peak heights (Fig. 14), as are concentrations of Mg (<0.8%) and Mn (average of about 1%), relative to that of Ca (Fig. 13). For example, the average Mg concentration is about 0.6%; if all this Mg was present as dolomite, the dolomite content would be about 3%. However, as discussed later, some of the Mg is in the detrital aluminosilicate fraction, so the dolomite contribution to total carbonate is not very significant compared to that from calcite.

The three independent estimates of amount of $CaCO_3$ (% Ca, X-ray diffraction peak height for calcite, and % $CaCO_3$ calculated from inorganic carbon; Fig. 13) in sediments deposited during the last 1500 years in Elk Lake all show similar trends with time. Variations in % $CaCO_3$ in sediments can be caused by one or a combination of: 1. variable production of $CaCO_3$; 2. variable dilution of $CaCO_3$ by other sediment components; and 3. variable dissolution of $CaCO_3$. The decrease in % $CaCO_3$ over the last 100 years (Fig. 13) probably is due to dilution of CaCO3 by organic matter (see increase in % organic carbon in Fig. 13) and terrigenous clastic material (as indicated by increases in aluminum and other clastic-related elements, discussed below).

Most of the other variations in % $CaCO_3$ do not appear to be related to simple dilution. For example, there is no apparent correlation between % $CaCO_3$ and % Al, the main indicator element for aluminosilicate clastic material (compare profiles for % $CaCO_3$ in Fig. 13 with that of % Al in Fig. 3C). As seen in Figure 13, there does appear to be a general antithetic relationship between % $CaCO_3$ and % OC, and the correlation coefficient between these two variables is -0.66 indicting an overall significant negative correlation. However, the variations in % OC are on the order of several percent whereas the variations in % $CaCO_3$ are an order of magnitude greater. The antithetic relationship between OC and $CaCO_3$ points out the difficulty of distinguishing the effects of production, dilution, and dissolution of $CaCO_3$ in producing variations in carbonate content of sediments in Elk Lake or any other hardwater lake. Precipitation of $CaCO_3$ usually is triggered by phytoplankton (cyanobacteria) blooms during middle to late summer which increase the pH of surface waters that are already saturated or supersaturated with $CaCO_3$ during the warm summer months (Dean and Megard, 1993). During summer stratification, decomposition of organic matter in the hypolimnion and at the sediment-water interface produces CO_2 that lowers the pH of the hypolimnion and sediment pore-waters causing dissolution. Thus, phytoplankton blooms in a hardwater lake during the summer create conditions that are conducive to both the production and dissolution of $CaCO_3$. Elk Lake is deeper than most hardwater lakes, with a 20-m thick hypolimnion that is undersaturated with $CaCO_3$ (Dean and Megard, 1993). Therefore, crystals of calcite that are produced in the epilimnion must settle through a thick undersaturated hypolimnion and then sit in undersaturated sediment pore waters. It is no wonder that most of the calcite produced at the surface never makes it to the bottom (Nuhfer and others, 1993).

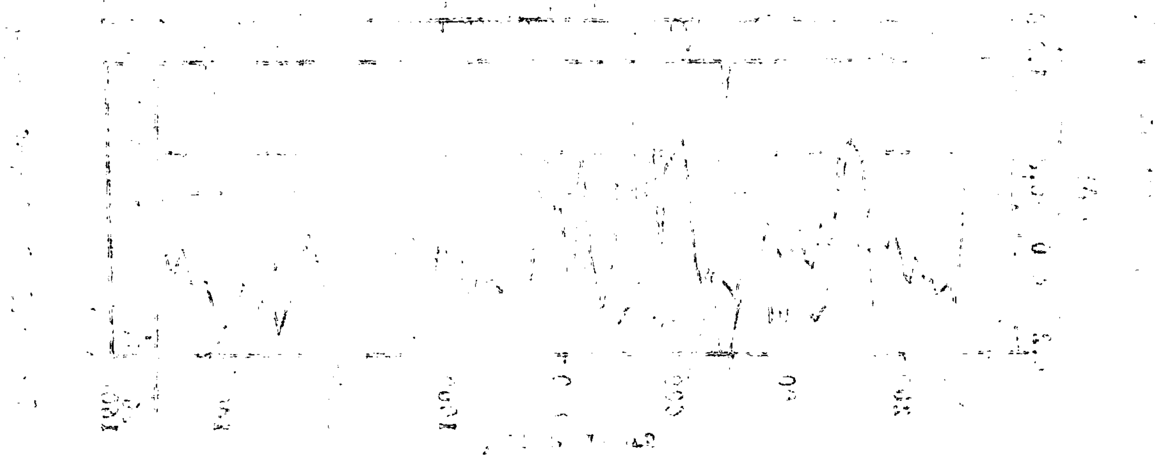
X-ray Diffraction Mineralogy:

The results of X-ray diffraction mineralogy, expressed as relative peak heights are given in Appendix III, and plotted versus time in Figure 14. The two main silicate minerals detected are quartz, and a feldspar peak at 28° 2θ (plagioclase). A second feldspar peak at 27° 2θ (orthoclase) was detected in a few samples. Because there are no large streams entering Elk Lake, most of this detrital clastic material probably is wind borne. This is obvious at times during the winter, when the surface of the ice on Elk Lake often contains a visible layer of eolian dust. The abundances of quartz and feldspar should, therefore, serve as proxy variables for variations in amount of eolian dust, i.e. windiness. If this is true, then the quartz and, particularly, the feldspar results plotted in Figure 14 suggest that conditions were windier prior to about 650 years ago, and between 200 and 400 years ago. The increases in abundances of quartz and feldspar during the last 100 years almost certainly is anthropogenic, mainly from increased land clearing and logging in the Itasca area.

The other minerals detected by X-ray diffraction are carbonates, predominantly low-Mg calcite, plus minor amounts of dolomite and rhodochrosite (Fig. 14). The most striking feature of the carbonate plots in Figure 14 is the marked decrease in carbonate minerals, particularly calcite and dolomite, beginning about 700 years ago, approximately coincident with the decrease in eolian activity predicted by the decreases in feldspar and, to a lesser degree, quartz. One possible explanation for the decrease in calcite and dolomite is that some of the calcite and dolomite is detrital, derived from calcareous glacial drift in the Itasca area in particular, and northwestern Minnesota in general. The source of this calcareous drift is Paleozoic limestones and dolomites to the northwest of Elk Lake in southern Manitoba (Wright, 1993). As discussed earlier, the amount of dolomite in the core is minor relative to the amount of calcite, which suggests that the amount of detrital calcite also is minor. Most of the calcite, and all of the rhodochrosite is precipitated in the surface waters (Dean and Megard, 1993; Nuhfer and others, 1993). Consequently, the decrease in rhodochrosite after 700 years ago cannot be explained by decrease in detrital material. A second possible explanation for the decrease in carbonate minerals at about 700 years ago is that the water chemistry of Elk Lake may have changed at that time. The salinity of the lake in general, and the concentration of bicarbonate in particular, may have been higher prior to 700 years ago. However, there is no independent evidence, e.g. from diatoms, to suggest that there was a change in water chemistry. A third, and more likely, explanation for the decrease in all carbonate minerals at a time coincident with an inferred decrease in eolian activity, is that with less wind stress, there was stronger and longer summer stratification, which, in turn, would produce a longer period of anoxia and more dissolution of all carbonate minerals. This alternative is supported by low abundances of diatoms in general, and summer-blooming *Aulacoseira* species in particular, after 700 years ago suggesting less turbulence and, therefore, a more stable summer stratification (see diatom discussion below).

Major, Minor, and Trace Elements:

The results of analyses of 24 major, minor, and trace elements are given in Appendix IV. Concentrations of 15 selected elements are plotted versus time in Figure 15. The amplitude of variations in total concentration for most elements is smaller over the last 1550 years of Elk Lake history when compared to variations that occurred over the entire Holocene history of Elk Lake. In order to try to give some perspective of the different scales of variations in element concentration, we have plotted percent aluminum (Al) in 5-year samples of Elk Lake sediments for the last 1550 years next to percent Al in 50-year samples of Elk Lake sediments for the last 10,400 years (Fig. 16). Note that the range of variation in % Al for the entire Holocene is considerably greater than that for the last 1550 years. Note also that the peaks in aluminum concentration during the last 1550 years were broadly defined by the 50-year sampling interval, but this sampling interval was not able to resolve the higher frequency variations defined by the 5-year sampling interval.



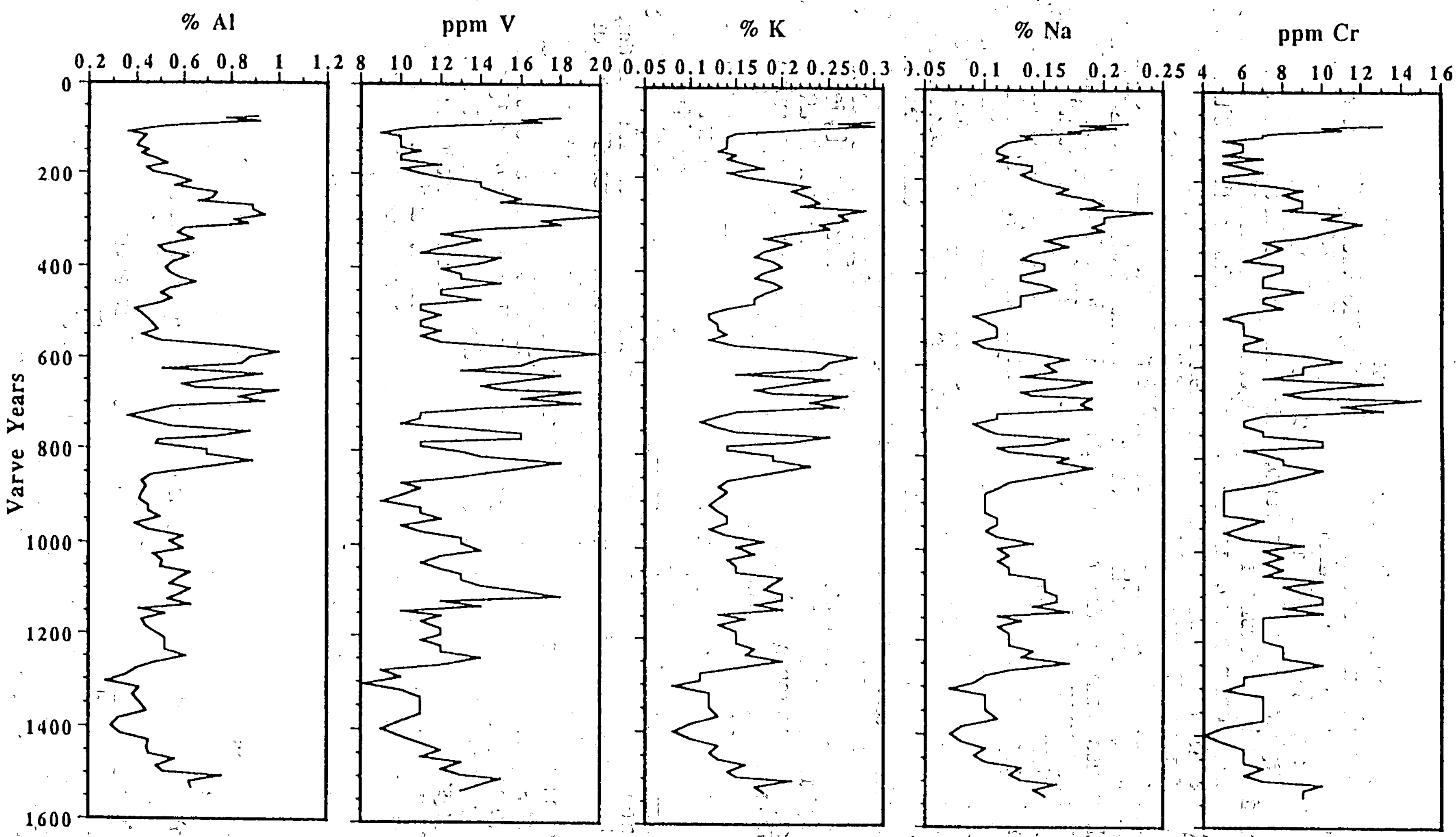


Figure 15. Profiles of concentrations (in percent or parts per million, ppm) of Al, V, K, Na, Cr, Ca, Sr, Fe, P, Mn, Mg, Ba, Cu, Zn, and Pb versus varve years for cores EL84B and EL83B-1.

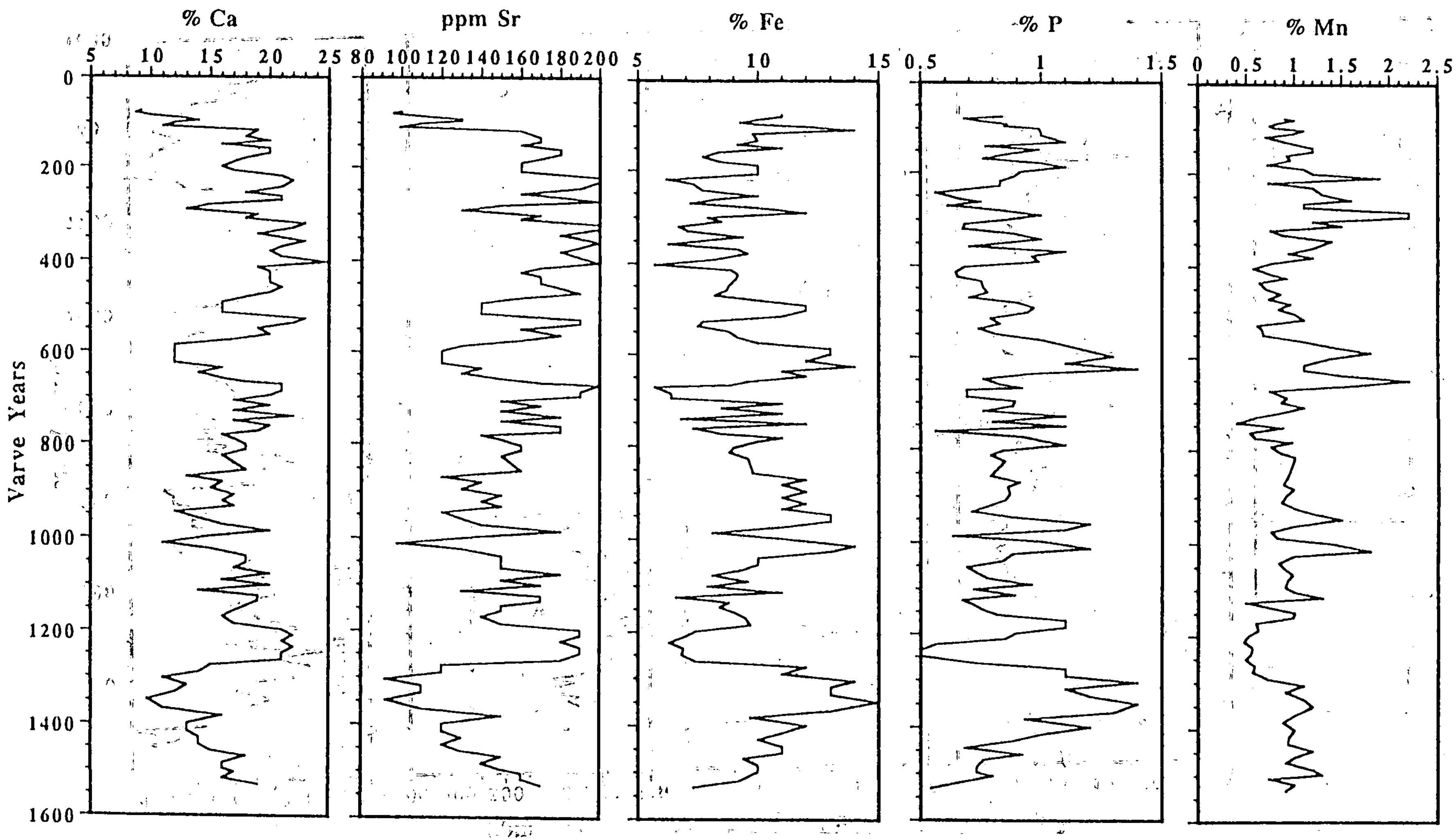
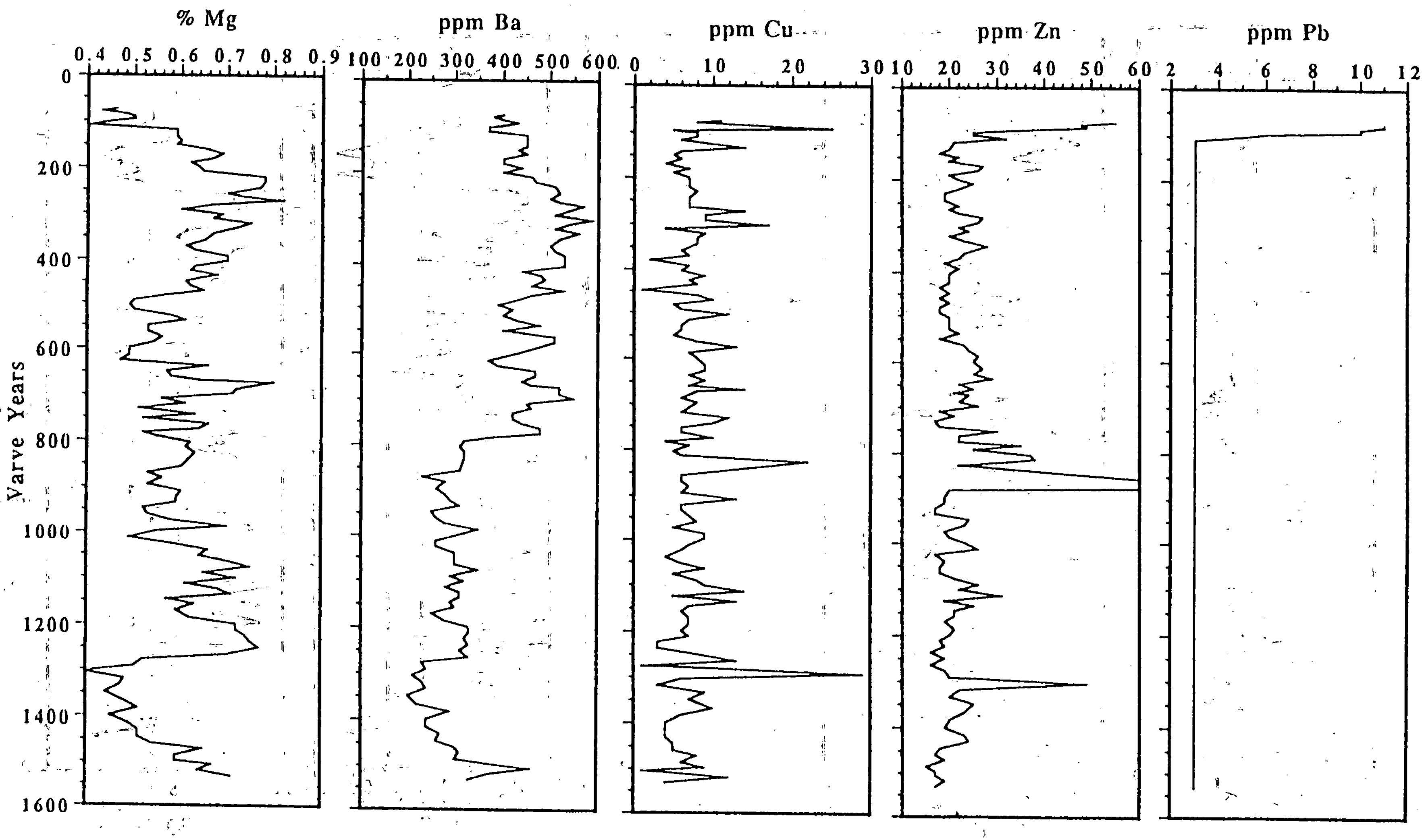


Figure 15 (continued)



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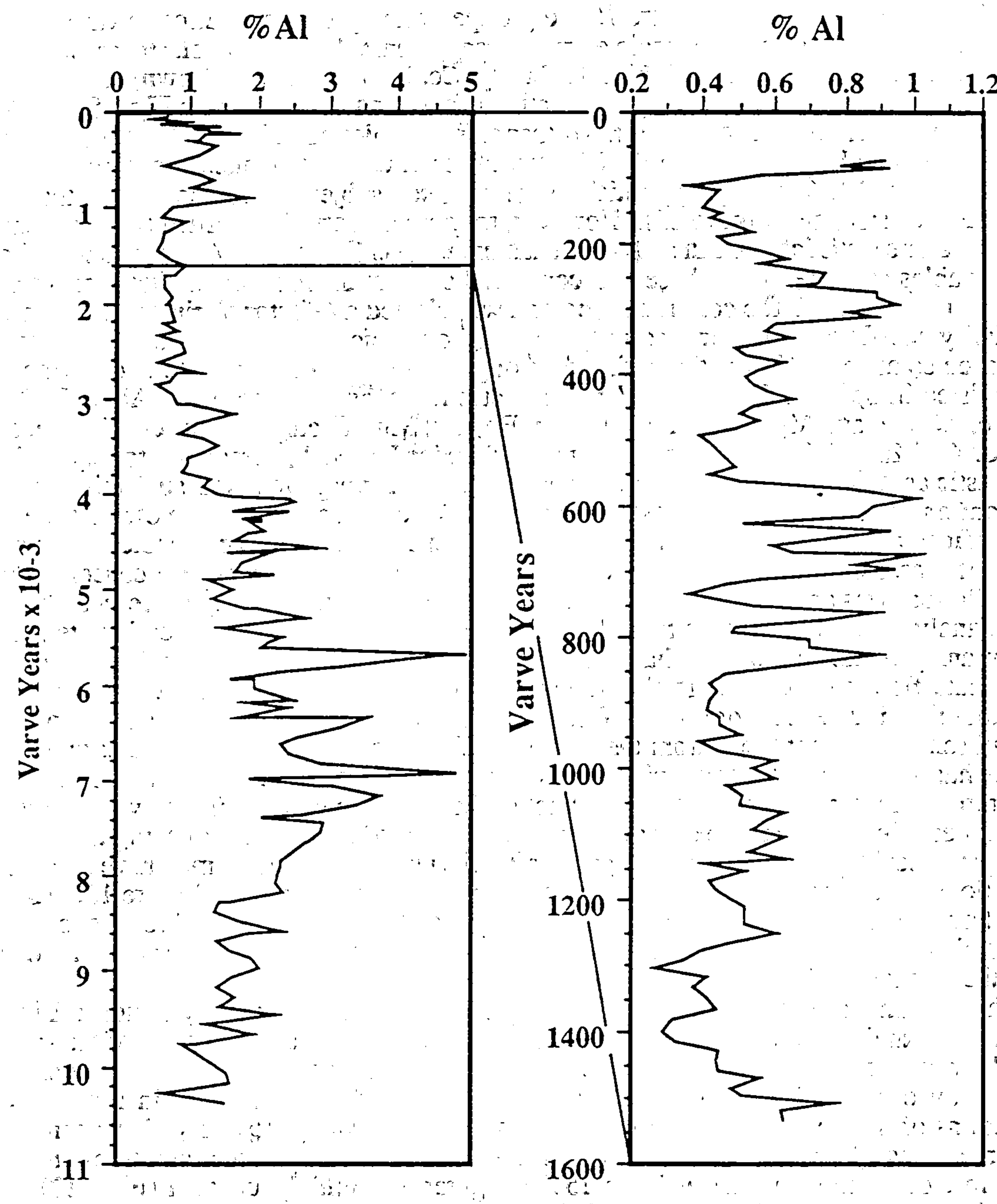

Figure 16. Profiles of percent Al in 50-year sediment samples over the last 10,400 years of Elk Lake history (left, from Dean, 1993) and in 5-year sediment samples over the last 1550 years (right).

The elements plotted in Figure 15 are grouped mainly by similarities in variations with time. These groupings define three main element associations: 1. a detrital clastic association (Al, V, K, Na, and Cr, plotted in Fig. 15, plus Ti, Li, La, Ce, Ni, and Co, not shown); 2. a carbonate association (Ca and Sr); and 3. a redox association (Fe, P, and Mn, plotted in Fig. 15, and As and Ga, not shown). The concentrations of five other elements plotted in Figure 15 (Mg, Ba, Cu, Zn, and Pb) showed no obvious associations with any of the three main element associations, but will be discussed later. These groupings initially were made on subjective comparison of the plots of concentration versus time (Figure 15). However, to more objectively confirm these associations using multivariate statistics, we ran an R-mode factor analysis (Miesch, 1976) in which similarities among variables are determined based on computed correlation coefficients between variables. After several runs through the computer program, we selected a 4-factor Varimax model in which the similarity coefficients (factor loadings) are based on projections onto axes in 4-dimensional space chosen so as to maximize the variance among variables. The four factors, or groups, with elements listed in order of decreasing Varimax factor loadings are: Factor 1 - Al, V, K, Na, Cr, Ti, La, Ce, Ni, Co, and Mg; Factor 2 - Ca, Sr, Ba, and Mg; Factor 3 - Mn, Ga, As, Fe, and P; and Factor 4 - Mo and Cu. The elements grouped under Factor 1 correspond to our subjective detrital clastic association; element grouped under Factor 2 correspond to our subjective carbonate association; and Factor 3 corresponds to our subjective redox association. Note that the factor analysis defined a second redox association based on Mo and Cu. We were unable to group these two elements based on variations in their concentration with time (see plot of Cu concentrations in Fig. 15). Barium was another element that we were not able to subjectively place in a group, but the factor analysis showed that Ba has a high degree of association with the carbonate fraction. The factor analysis showed that Mg had about an equal degree of association with both the clastic and carbonate fractions suggesting that the amount of Mg is, on average, about equally split between aluminosilicates and dolomite. Concentrations of Pb were below the detection limit (3 ppm) in all samples except those from the most recent sediments (Fig. 15). This clearly indicates that there has been an anthropogenic input of Pb to lake sediments in this remote part of northwestern Minnesota. Because there was not sufficient sample to obtain analyses of the most recent sediments in Elk Lake, we do not know how high the Pb concentrations might be, but it is interesting to speculate that sediments deposited after the use of leaded fuels may have made the Pb concentrations significantly higher than the maximum of 11 ppm shown in Figure 15. Zinc also seems to have a distinct anthropogenic component (Fig. 15). We were unable to qualitatively group this element, but the factor analysis showed that Zn has a low degree of association with Factor 1, the detrital clastic factor.

The detrital clastic fraction, represented by Factor 1 elements, is very minor in Elk Lake today and enters mainly as windblown silt and clay (eolian dust). A larger fraction of the sediment in Elk Lake was composed of detrital clastic material in the past, particularly during the arid mid-Holocene prairie period (Dean, 1993; see plot of % Al for the last 10.4 ky in Fig. 16). The concentrations of aluminum and other detrital clastic elements (Fig. 15) vary significantly with cyclic fluctuations on decadal and centennial scales. The centennial-scale variations show best when the raw data are smoothed using a 15% weighted smoothing function (Fig. 17). Four periods of increased influx of eolian silt and clay, each lasting 300 to 400 years, are inferred from the aluminum concentration profile (Fig. 17): one from the beginning of the record to about 1400 years ago; a second from about 1300 to 1000 years ago; a third, major, period from about 850 to 550 years ago with five distinct peaks each lasting 50-60 years; and a fourth, major, period from about 450 to 150 years ago coincides with the Little Ice Age (LIA in Fig. 17) with a peak during the Maunder Sunspot Minimum (MM in Fig. 17). The most recent increase in detrital clastic material (aluminum and other proxy elements) over the last 100 years probably is the result of land clearing, logging, and other land disturbances by European settlers.

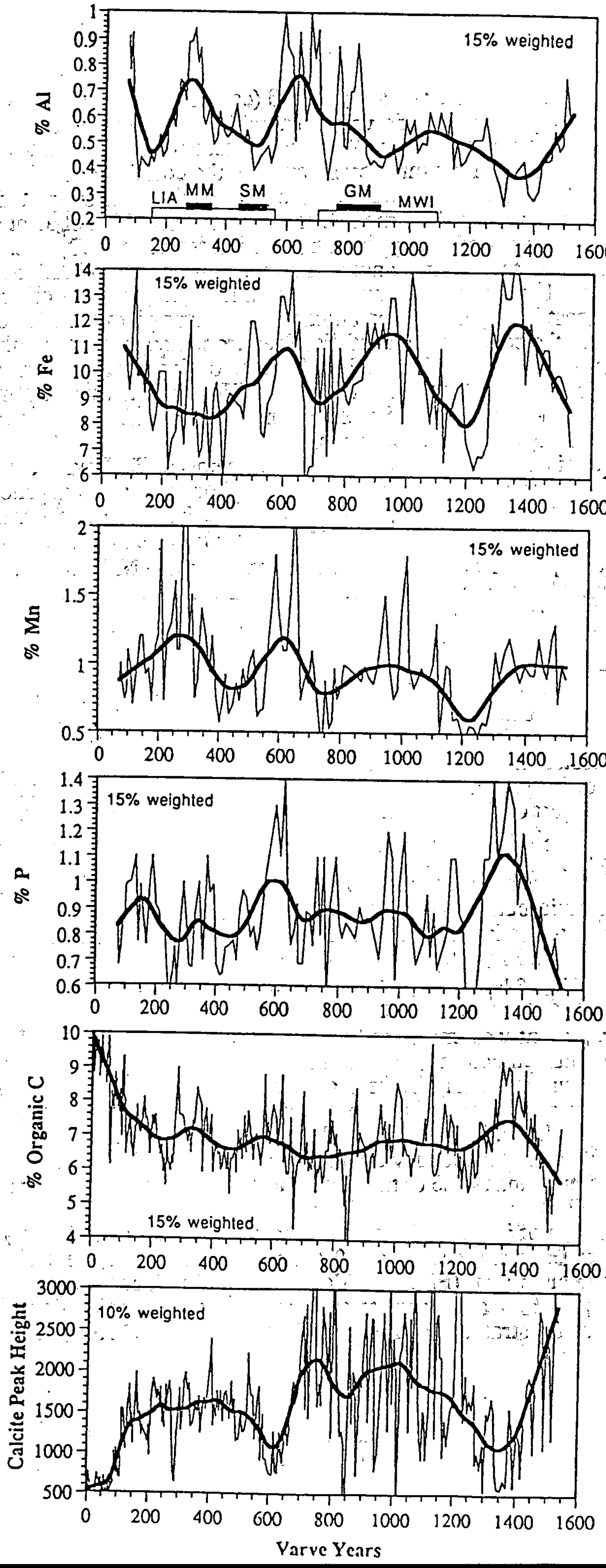

Figure 17. Smoothed profiles (15% weighted smoothing) of % Al, % Fe, % P, % OC, and calcite peak height versus varve years for cores EL84B and EL83B-1. Events indicated at the bottom of the % Al profile are: LIA = Little Ice Age; MM = Maunder sunspot Minimum; GM = Grand sunspot Maximum; MWI = Medieval Warm Interval.

The elements grouped under Factors 2 and 3 (carbonate and redox) have a distinct inverse relationship as shown by the antithetic variations with time between Ca and Fe (Fig. 15) and between calcite peak height and Fe (Fig. 17). The inverse relationship between $CaCO_3$ and the redox-related elements is best illustrated by Fe and Ca; the correlation coefficient between these two variables is -0.86. The cause of this inverse relationship was suggested earlier under the discussion for carbonate and organic carbon. The same decomposition of algal organic matter that produces CO_2, lowers the pH of the hypolimnion, and dissolves $CaCO_3$, also consumes O_2 and causes the hypolimnion to become anoxic during summer stratification. At present, the hypolimnion does not become anoxic until late summer (Megard and others, 1993), but it is possible that in the past it may have been anoxic for a longer period of time each year. During summer stratification, the concentrations of dissolved iron, manganese, and phosphorus build up in the hypolimnion (Megard and others, 1993) because of decomposition of organic matter and dissolution of authigenic minerals that formed in the epilimnion and (or) metalimnion (Nuhfer and others, 1993). Some of this release of dissolved ions occurs in the hypolimnion, but most of the ions come from previously deposited sediments.

The inferred or identified iron and manganese minerals in Elk Lake sediments include pyrite observed in scanning electron micrographs, X-ray amorphous iron and manganese oxyhydroxides, manganese carbonate (rhodochrosite), and one or more iron phosphate minerals tentatively identified as rockbridgeite [$(Fe, Mn)Fe_2(PO_4)_3(OH)_5$] and (or) lipscombite [$Fe^{2+}Fe^{3+}(PO_4)_2(OH)$] based on weak X-ray diffraction peaks (Nuhfer and others, 1993; Dean, 1993). Iron and manganese oxyhydroxides have been identified in thin sections of Elk Lake sediments as reddish-brown and black bands, respectively, within the annual varve units (Anderson, 1993; Nuhfer and others, 1993). Although iron and manganese both accumulate in sediment traps during summer and winter stratification periods, the precipitation of oxyhydroxides and rhodochrosite seems to be associated with spring and fall periods of overturn. This is true particularly in the fall when iron- and manganese-rich, oxygen- and carbonate-depleted hypolimnetic waters mix with oxygen- and carbonate-rich epilimnetic waters (Nuhfer and others, 1993). Material collected in sediment traps usually appears bright orange after fall overturn due to the abundance of a ferric hydroxide floc. Most of the manganese that precipitates is redissolved in the hypolimnion, but most of the iron is not (Nuhfer and others, 1993). The lack of dissolution of iron probably is related to the fact that ferric hydroxide colloids or gels tend to be fairly stable whereas manganese oxy-hydroxides are much more labile (e.g. Tipping and others, 1981; Stauffer and Armstrong, 1986). Further reduction of iron and manganese minerals occurs in the sediments as evidenced by the rapid build-up of dissolved iron and manganese in the hypolimnion, which takes place just above the sediment-water interface soon after spring stratification (Megard and others, 1993; Nuhfer and others, 1993). Most of the reduced manganese that is released from the sediments probably escapes to the hypolimnion, but a significant amount of the reduced iron is fixed in the sediments as iron sulfide and iron phosphate. This removal of dissolved phosphorus from the lake water, presently estimated to be about 1.2 mg P/cm^2/yr (Dean, 1993), probably has retarded the natural eutrophication of Elk Lake. It is commonly thought that iron phosphate minerals mostly form authigenically in the sediments (see reviews by Nriagu, 1972, Nriagu and Dell, 1974, and Hearn and others, 1983), but they are common and persistent components in sediment traps from Elk Lake, indicating that they form in the water column (Nuhfer and others, 1993). Iron phosphate was particularly abundant in deep traps deployed in Elk Lake where it commonly comprised more than 40% of the crystalline fraction during the summer, fall, and winter (Nuhfer and others, 1993).

The concentration of iron in Elk Lake sediments exhibits high frequency cyclic variations with periodicities of ca. 50 years as well as 300-400 year cycles that are generally antithetic to the 300-400 year cycles in aluminum (Fig. 17). Variations in Mn, P, and OC tend to follow those of Fe, and variations in all four are opposite to those for calcite peak height (Fig. 17). These relationships are best illustrated for the period from 1000 to 1550 varve years (Fig. 18).

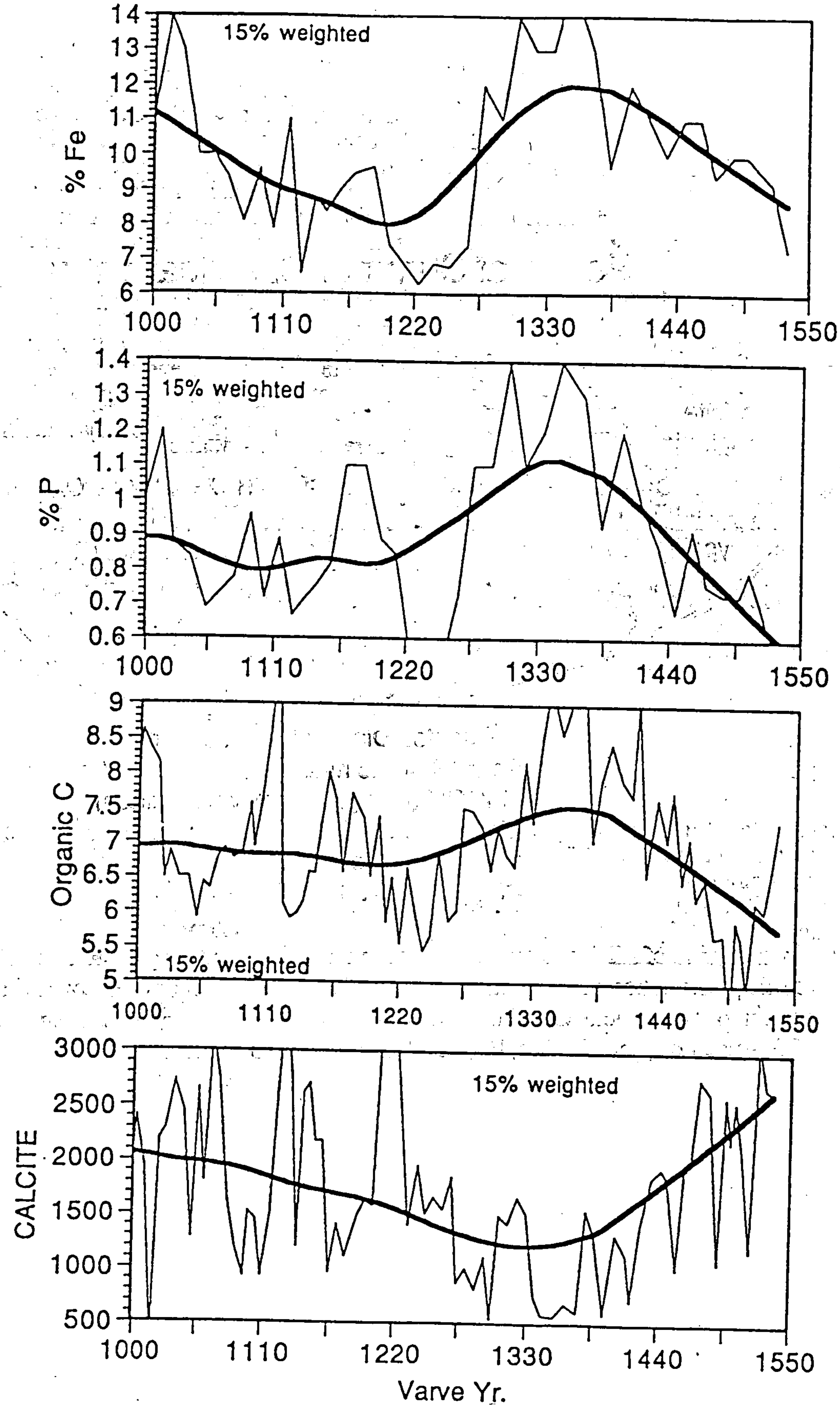

Figure 18. Smoothed profiles (15% weighted smoothing) of % Fe, % P, % OC, and calcite peak height versus varve years for the interval 1000 to 1550 years in cores EL84B and EL83B.

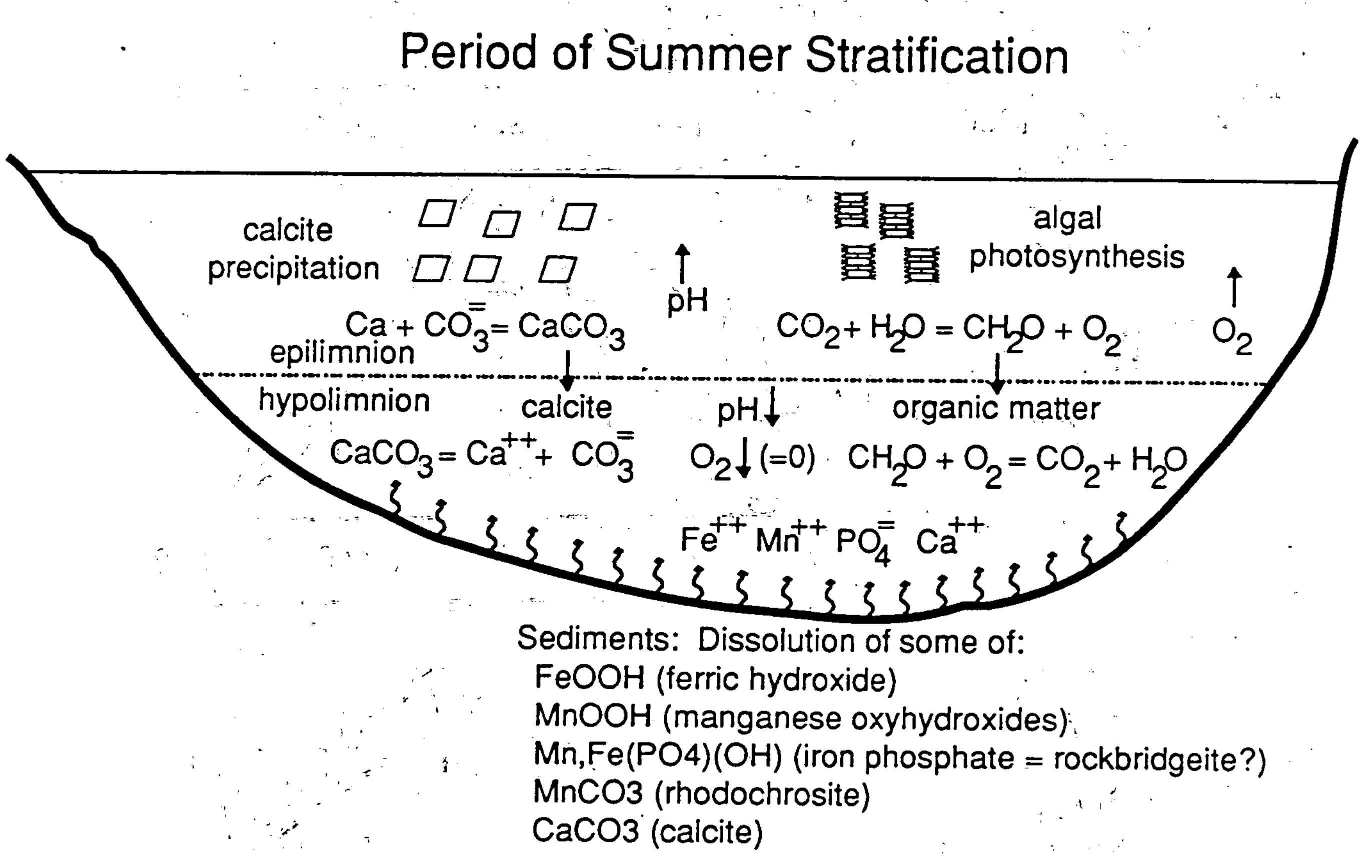

Figure 19. Cross section of Elk Lake during summer stratification showing the relationships between calcite precipitation, algal photosynthesis, pH, and dissolved oxygen concentration in the epilimnion; and calcite dissolution, organic matter decomposition, pH, and concentrations of dissolved oxygen, Fe, Mn, PO_4, and Ca in the hypolimnion.

The inferred relationships among the distributions of iron, manganese, phosphorus, carbonate, and organic carbon in the water and sediment of Elk Lake during summer stratification and with the presence of an anoxic hypolimnion are shown diagrammatically in Figure 19. High organic productivity produces high fluxes of organic carbon and precipitated $CaCO_3$ to the hypolimnion, but also lowers the pH and oxygen of the hypolimnion. Reduced iron, manganese, phosphorus, and calcium released from the sediment accumulates in the reducing hypolimnion. When the hypolimnetic water mixes with oxygen- and carbonate-rich epilimnetic water, the reduced iron and manganese precipitate as iron and manganese oxy-hydroxides, iron-manganese phosphates, and manganese carbonate. Some of these precipitated iron and manganese minerals, as well as some $CaCO_3$, dissolves in the hypolimnion and sediment pore water, but some variable amount does not dissolve and is incorporated in the sediment.

During periods of increased productivity (e.g. ca. 1400 to 1300 years ago; Fig. 17), more organic carbon was delivered to the hypolimnion and the sediment-water interface. This caused the organic carbon content of the sediments to increase, but also caused the pH of the hypolimnion to decrease, and to decrease for a longer period of time, which dissolved more $CaCO_3$ so that less was delivered to the sediment-water interface. Anoxia in the hypolimnion expanded in time (duration) and space (volume), allowing a greater build-up of iron, manganese, and phosphorus. The result was that more iron, manganese, and phosphate minerals were precipitated during overturn, and delivered to the sediment-water interface. The concentrations of OC, Fe, Mn, and P in the sediments all increased, while that of $CaCO_3$ decreased (Fig. 17). During periods of decreased organic productivity (e.g. ca. 1300 to 1200 years ago; Fig. 17), the opposite occurred.

If this productivity-redox relationship is true, then variations in the concentration of organic carbon or any of the redox-related elements can be used as a proxy for variations in paleoproductivity. The redox cycles, in turn, provide a feed-back loop to productivity by sequestering phosphorus and limiting the rate of eutrophication.

Diatoms:

Elk Lake Phytoplankton

Although the kinds and successional dynamics of phytoplankton in Elk Lake have received no systematic study, both diatoms and cyanobacteria play important roles in organic production, nutrient cycling and hydrochemical changes in Elk Lake that directly or indirectly affect the composition and thickness of varves that accumulated on the lake bottom. Two reasonably complete analyses of phytoplankton populations by A. L. Baker in the fall of 1967 and the late spring of 1968 indicated that cyanobacteria (bluegreen algae) dominated in the late summer, and Bacillariophyta (diatoms) dominated in the spring (Fig. 20, Table 2). This suggests that Elk Lake conforms in a general way to the character of phytoplankton succession typical of many temperate freshwater lakes (e.g. Hutchinson, 1967, p. 400).

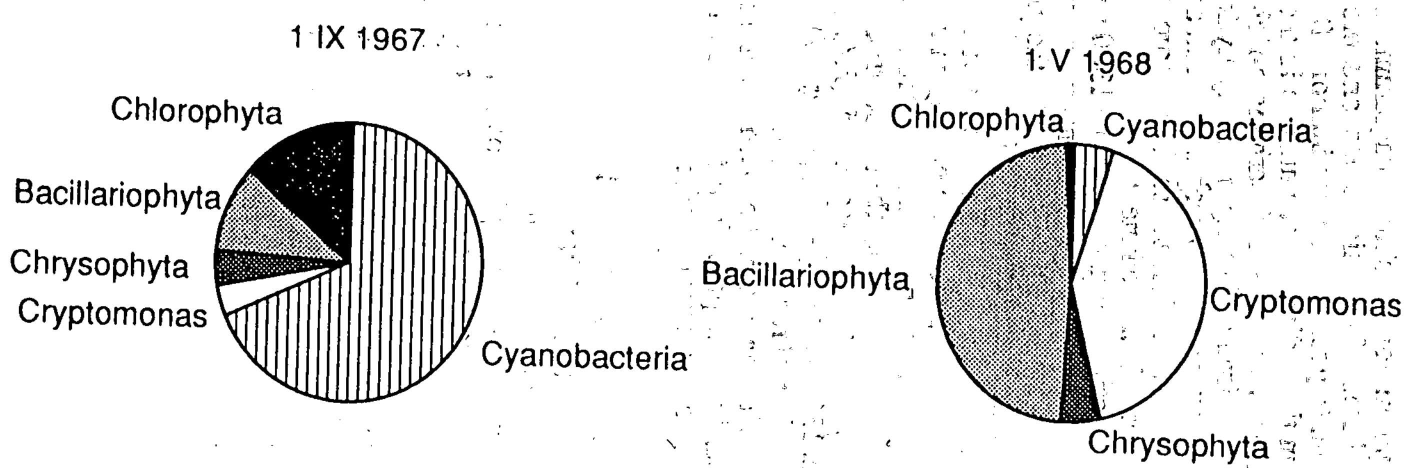

Figure 20. Proportional representation of phytoplankton groups present in the epilimnion of Elk Lake on September 1, 1967 and on May 1, 1968. From Megard and others (1993).

TABLE 2. MEAN CONCENTRATIONS OF PHYTOPLANKTON IN THE UPPER METER OF ELK LAKE

	September 1, 1967	May 1, 1968
BACILLARIOPHYTA		
Synedra acus		114
Tabellaria flocculosa		71
Fragilaria crotonensis	42	25
Asterionella formosa	4	37
Cyclotella sp.	1	
Navicula		30
Aulacoseira italica		29
Stephanodiscus niagarae		2
CYANOBACTERIA		
Anabaena sp.	205	
other species	58	12
CHRYSOPHYTA	15	29

Values, in units (naturally occurring uni-cells, filaments or colonies) per milliliter, from A. L. Baker (written communication, 1987). Modified from Megard and others (1993).

Phytoplankton analyses throughout the water column of Elk Lake in late spring of 1968 (May 1, 1968; Fig. 21) indicate that most of the phytoplankton population was located in the epilimnion, although diatoms were fairly common at all depths as a result of spring circulation. Cyanobacteria appear to be stratified at a depth of 5 m, which may have been near the thermocline at that time because algal stratification typically accompanies thermal stratification in Elk Lake and other nearby lakes (Baker and Brooks, 1971). The highest chlorophyll concentrations in Elk Lake are usually in the thermocline (Megard and others, 1993).

Sediment trap studies (Nuhfer and others, 1993; Bradbury, 1988) provide additional information about the variability of diatom succession and productivity in Elk Lake between 1979 and 1984. The trap studies document the seasonal distribution of diatom production at Elk Lake and provide examples of the general mechanism (strength and duration of spring and fall circulation) that determines the magnitude of diatom production. The timing and strength of circulation controls the supply rates of principal nutrients for diatoms, silicon (Si) and phosphorus (P), and the preferred light regime for photosynthesis.

Two of the most common diatoms in Elk Lake, *Stephanodiscus minutulus* and *Fragilaria crotonensis*, reflect differential reliance on nutrient and growth requirements. *Stephanodiscus minutulus* and other small species of *Stephanodiscus* prosper when supply ratios of Si:P are <1 (Kilham and Kilham, 1978). In addition, these apparently low-light species (Kilham and others, 1986) can take advantage of low spring illumination levels to grow. *Fragilaria crotonensis* on the other hand, appears to require higher illumination levels. Because it is a successful competitor for phosphorus, *F. crotonensis* can prosper when phosphorus supply ratios are low (Si:P >>1) (Kilham and Kilham, 1978). These relationships are schematically shown (Fig. 22) in the context of the limnological and seasonal changes that affect the abundance and distribution of silicon, phosphorus, and light. The phosphorus requirement for *Stephanodiscus minutulus* is largely satisfied by regeneration from sediments during winter stagnation and its transportation to the photic zone during spring circulation. Long periods of vigorous circulation (to the bottom of the lake) will promote large blooms of *Stephanodiscus minutulus*. Silicon is delivered to the lake by groundwater and by solution of diatom frustules in the littoral zone. As supply ratios of phosphorus diminish, *Fragilaria crotonensis* is favored by its superior ability to compete for phosphorus in low concentrations if silicon is abundant. *Fragilaria crotonenses* will characterize weak or late spring circulation periods (Bradbury, 1988) and (or) fall circulation (Nuhfer and others, 1993).

Less is known about diatom dominance during summer stagnation, although *Fragilaria crotonensis* was comparatively common in Elk Lake in September, 1967 (Table 2). *Cyclotella bodanica* and *Tabellaria flocculosa* also appear to characterize sediments trapped during late summer months (Nuhfer and others, 1993).

Asterionella formosa, a common diatom in the Elk Lake phytoplankton, generally accumulates in traps during the late fall or early winter, after the lake freezes. Whether it can bloom under the ice, or simply settles slowly after proliferation during the final stages of circulation is not known.

Phytoplankton photosynthesis relates to sedimentary processes and sediment composition in Elk Lake in two important but fundamentally different ways. The varves are composed of couplets of alternating dark olive and light gray laminae (Anderson, 1993). The dark layers contain siliceous cells (frustules) of diatoms and therefore the thickness of these layers are related in part to diatom productivity. Occasionally, diatom productivity can be so great as to produce a waxy, light tan- or olive-colored layer representing a large, seasonal bloom. However, for the most part, the light layers of a varve couplet are composed of $CaCO_3$, which is formed in the late summer when epilimnetic water that is oversaturated with respect to calcite precipitates $CaCO_3$ due to phytoplankton (especially cyanobacteria) photosynthesis (Dean and Megard, 1993).

<u>High Resolution Diatom Analyses of the Past 1550 Years</u>

The concentration (valves/mm microscope transect) of total diatoms and of dominant taxa (Figs. 23-27) indicate limnological variability for the past 1550 years in Elk Lake. *Fragilaria crotonensis*, *Stephanodiscus minutulus*, and *Asterionella formosa* are the dominant planktic diatoms in Elk Lake (Fig. 24). The other diatom species (Figs. 25-27) exhibit sporadic dominance or sub-dominance for greater or lesser periods of time that reflect specific climatic - limnologic conditions associated with nutrient cycling and insolation. Although the sediments of Elk Lake deposited during the past 1550 years generally are highly diatomaceous, there are periods of several decades throughout this interval during which diatom production (diatoms/mm)was low or absent (Fig.23).

Benthic motile diatoms (*Navicula* species) and benthic attached diatoms (*Cocconeis placentula*, *Gomphonema,* and *Cymbella* species) can constitute a significant proportion of the diatom content at some times (Figs. 25 , 26) that generally correlate with times of overall high diatom concentration.

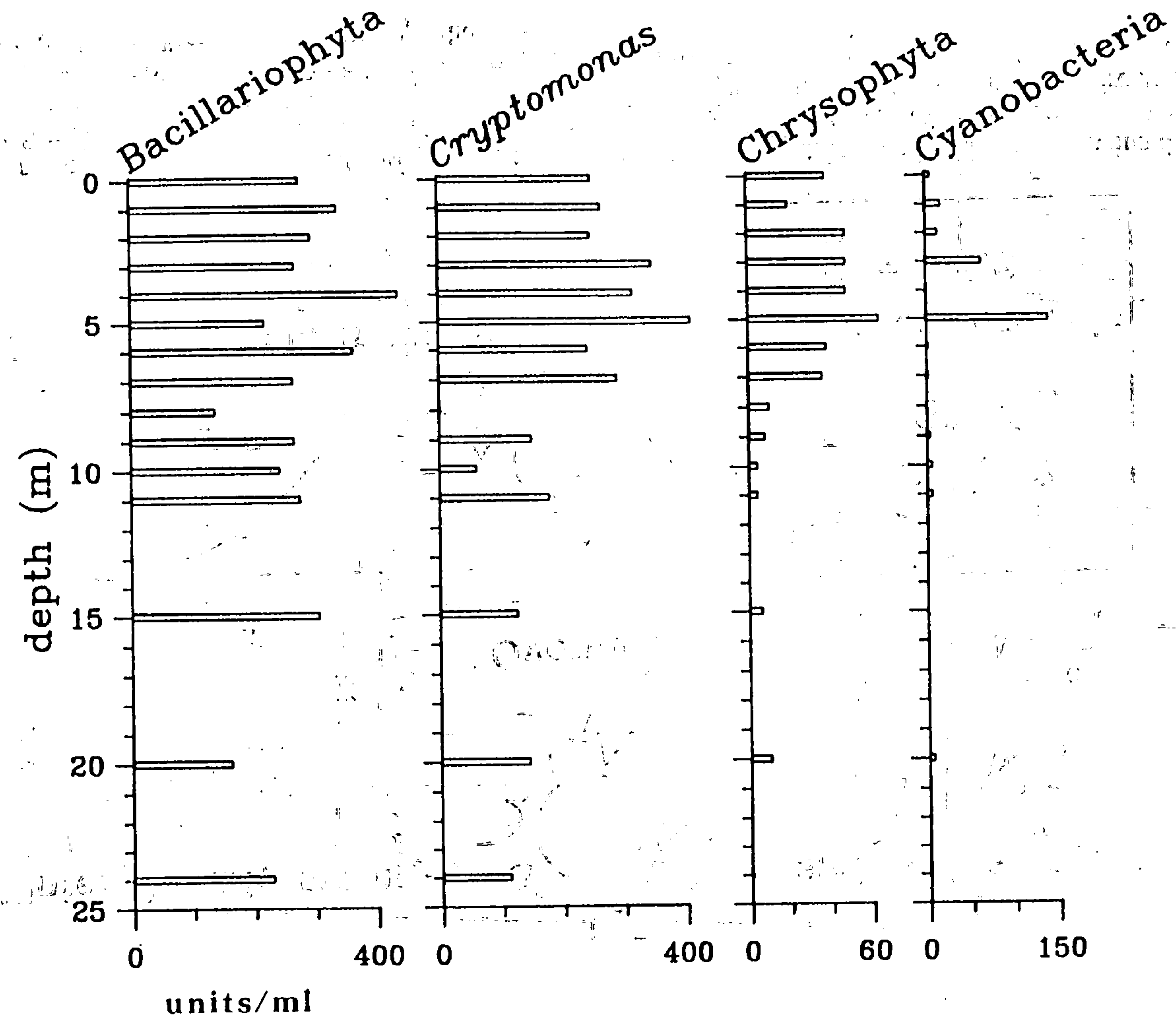

Figure 21. Abundance of algal groups at different depths in Elk Lake on May 1, 1968. From Megard and others (1993).

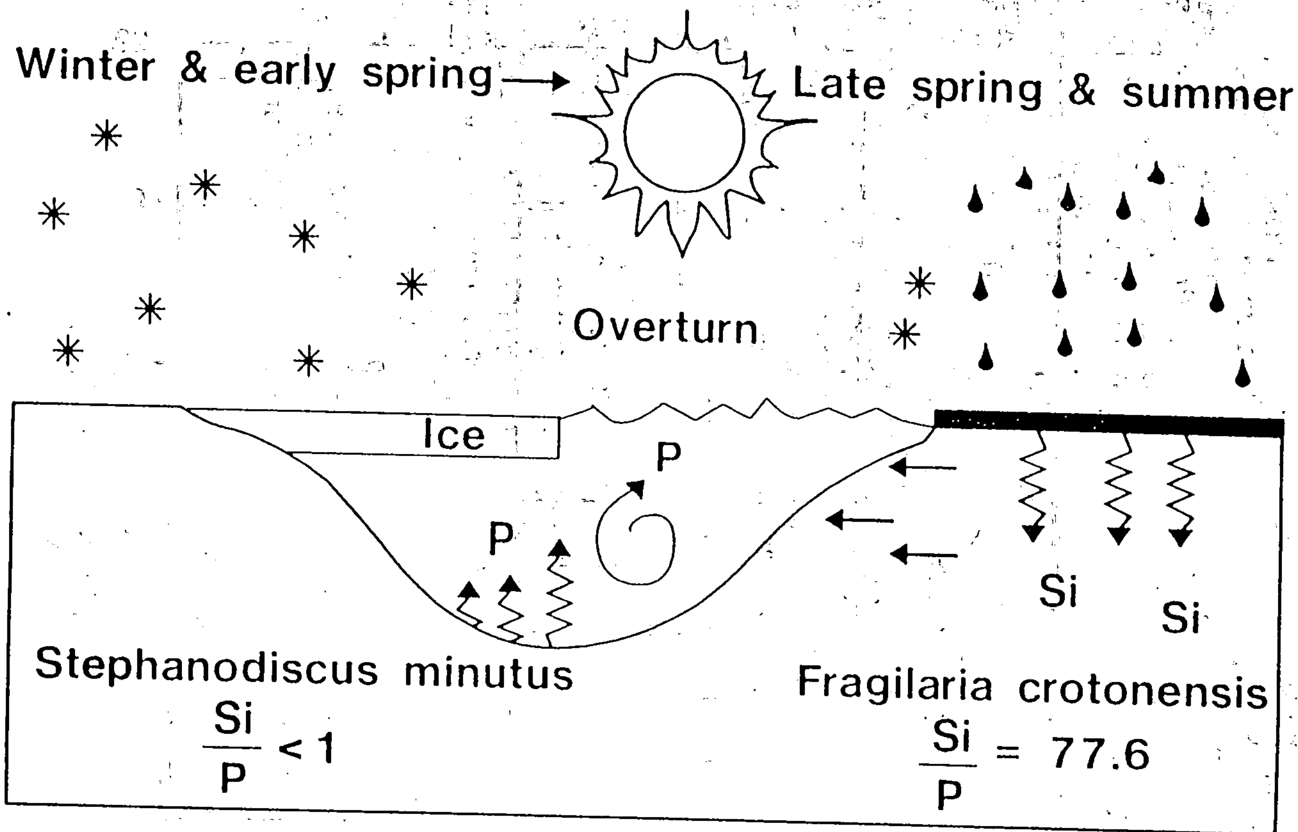

Figure 22. Schematic representation of spring circulation and the beginning of summer stratification in Elk Lake showing the succession of diatoms from *Stephanodiscus minutulus* that requires low Si:P supply ratios to *Fragilaria crotonensis* that favors high Si:P ratios. Sources of phosphorus are from mixing of nutrient-rich anoxic hypolimnetic water during spring circulation (arrows labeled "P"). Sources of silicon are from infiltration of groundwater to the littoral zone of the lake (arrows labeled Si). Some silicon is derived from dissolution of diatoms in the littoral zone.

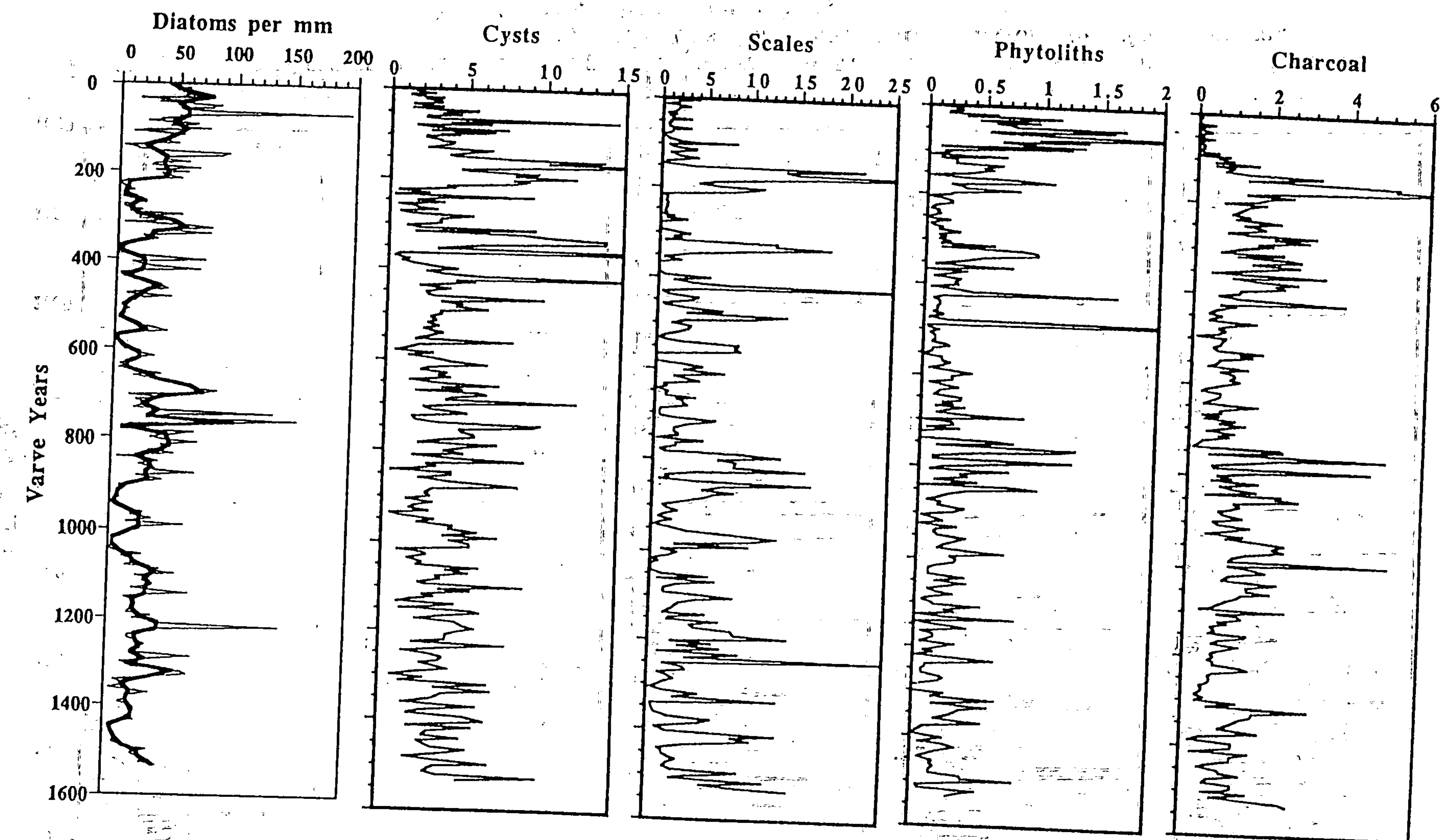

Figure 23. Profiles of concentrations (in numbers per mm of transect across a microscope slide) of siliceous microfossils and charcoal versus varve years for cores EL84B and EL83B-1. Cysts = stomatocysts of chrysophyte algae; Scales = chrysophyte scales; Phytoliths = intercellular siliceous bodies (phytoliths) of vascular plants; Charcoal = charred and carbonized fragments of vascular plants observed in diatom preparations

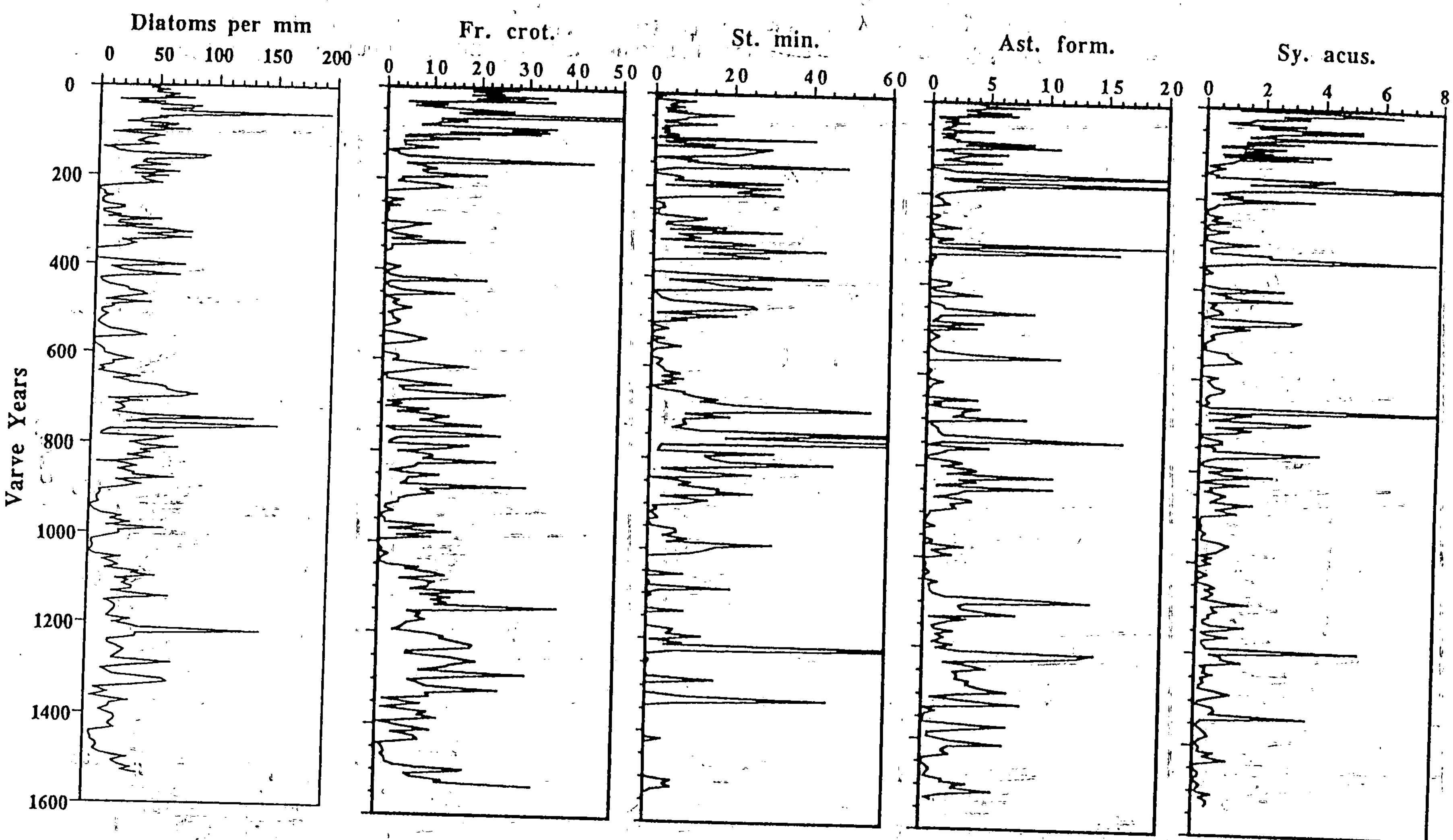

Figure 24. Profiles of concentrations (in numbers per mm of transect across a microscope slide) of total diatoms and the following planktic diatom species versus varve years for cores EL84B and EL83B-1: Fr. crot. = *Fragilaria crotonensis*; St. min. = *Stephanodiscus. minutulus*; Ast. form. = *Asterionella formosa*; Sy. acus. = *Synedra acus*.

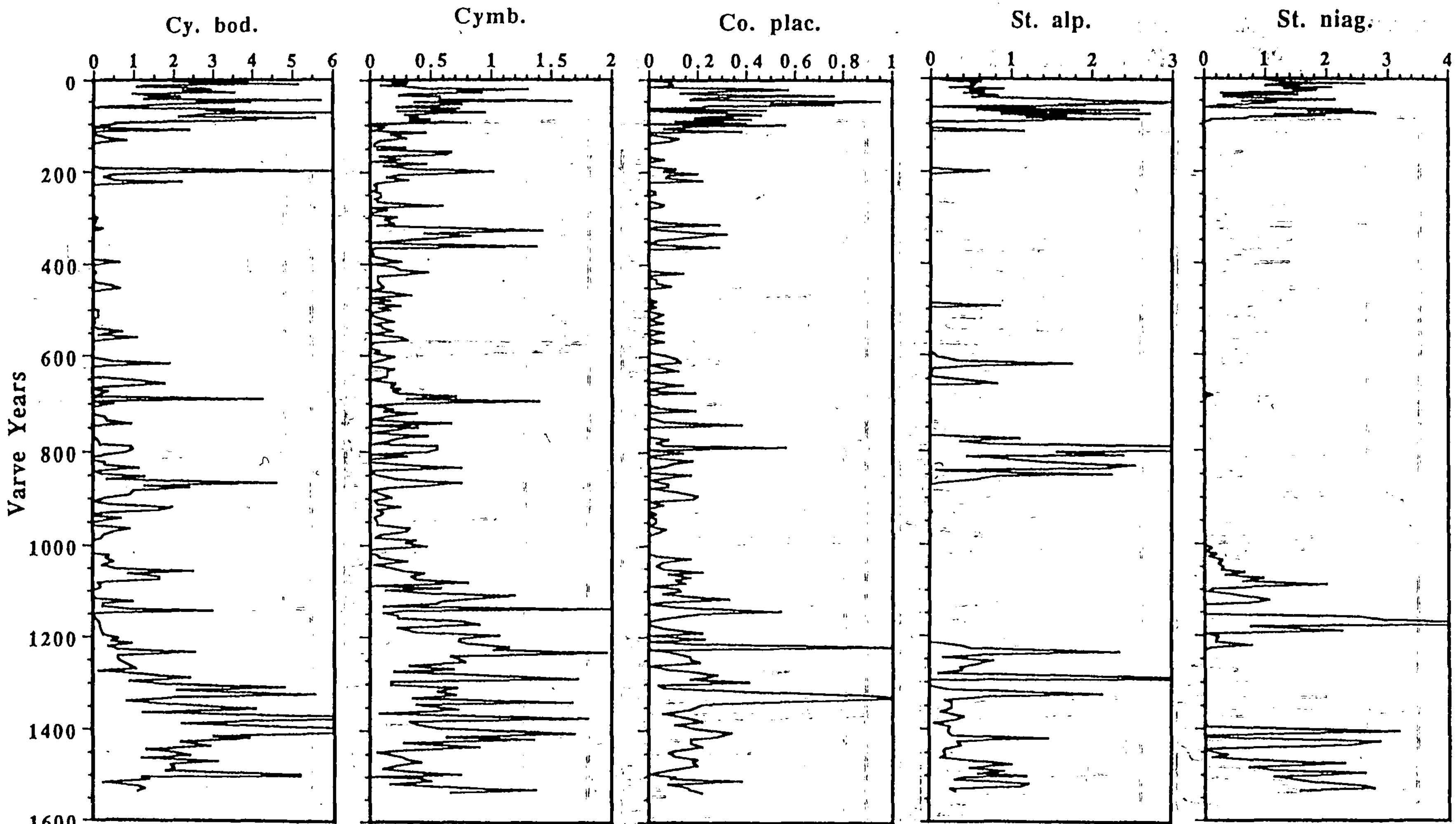

Figure 25. Profiles of concentrations (in numbers per mm of transect across a microscope slide) of the following planktic diatom species versus varve years for cores EL84B and EL83B-1; Cy. bod. = *Cyclotella bodanica*; Cymb. = *Cymbella* species; St. alp. = *Stephanodiscus alpinus*; St. niag. = *Stephanodiscus niagarae*.

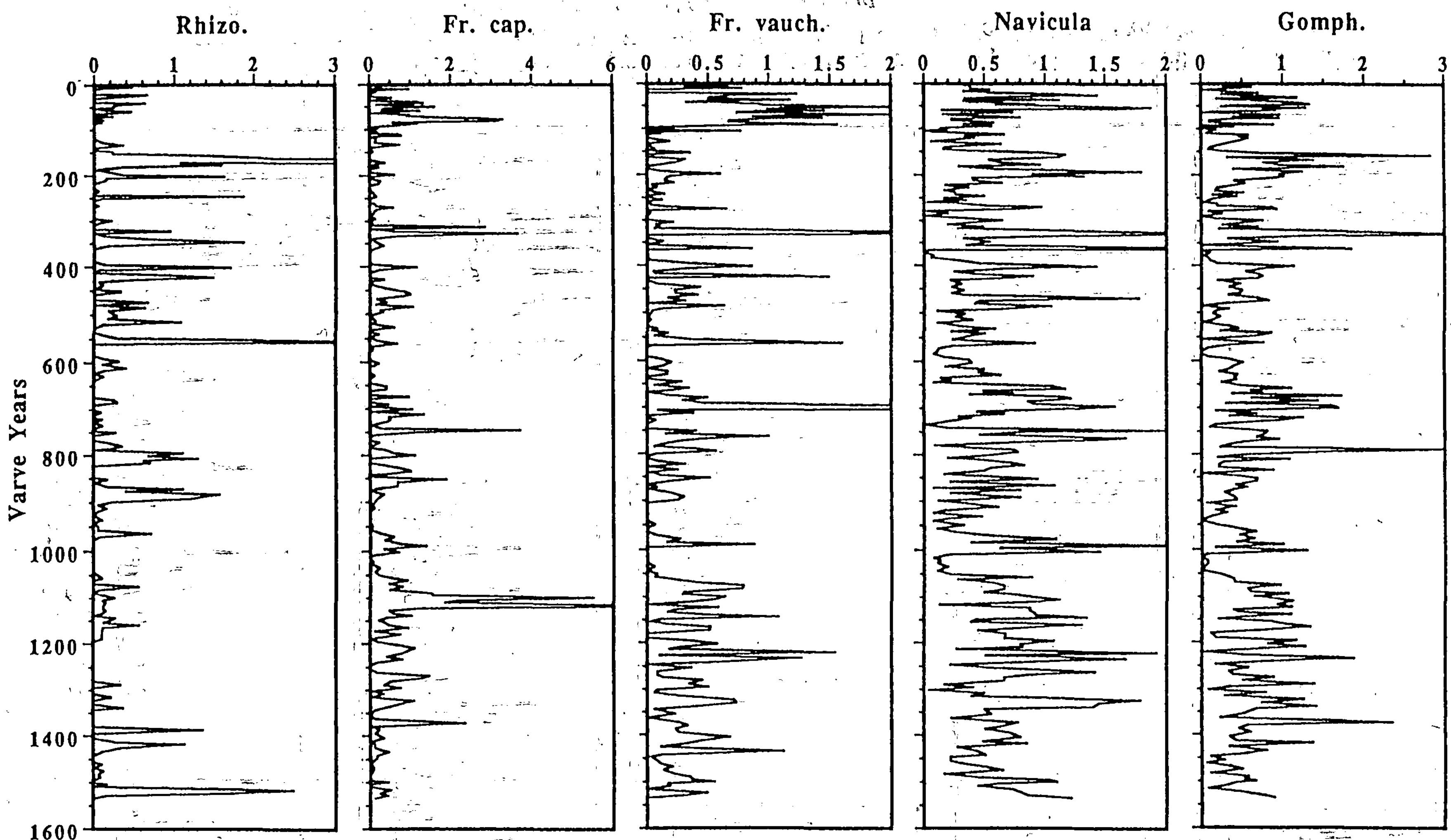

Figure 26. Profiles of concentrations (in numbers per mm of transect across a microscope slide) of the following planktic diatom species versus varve years for cores EL84B and EL83B-1: Rhizo. = *Rhizosolenia eriensis*; Fr. cap. = *Fragilaria capucina*; Fr. vauch = *Fragilaria vaucheriae*; Navicula = *Navicula species*; Gomph. = *Gomphonema* species.

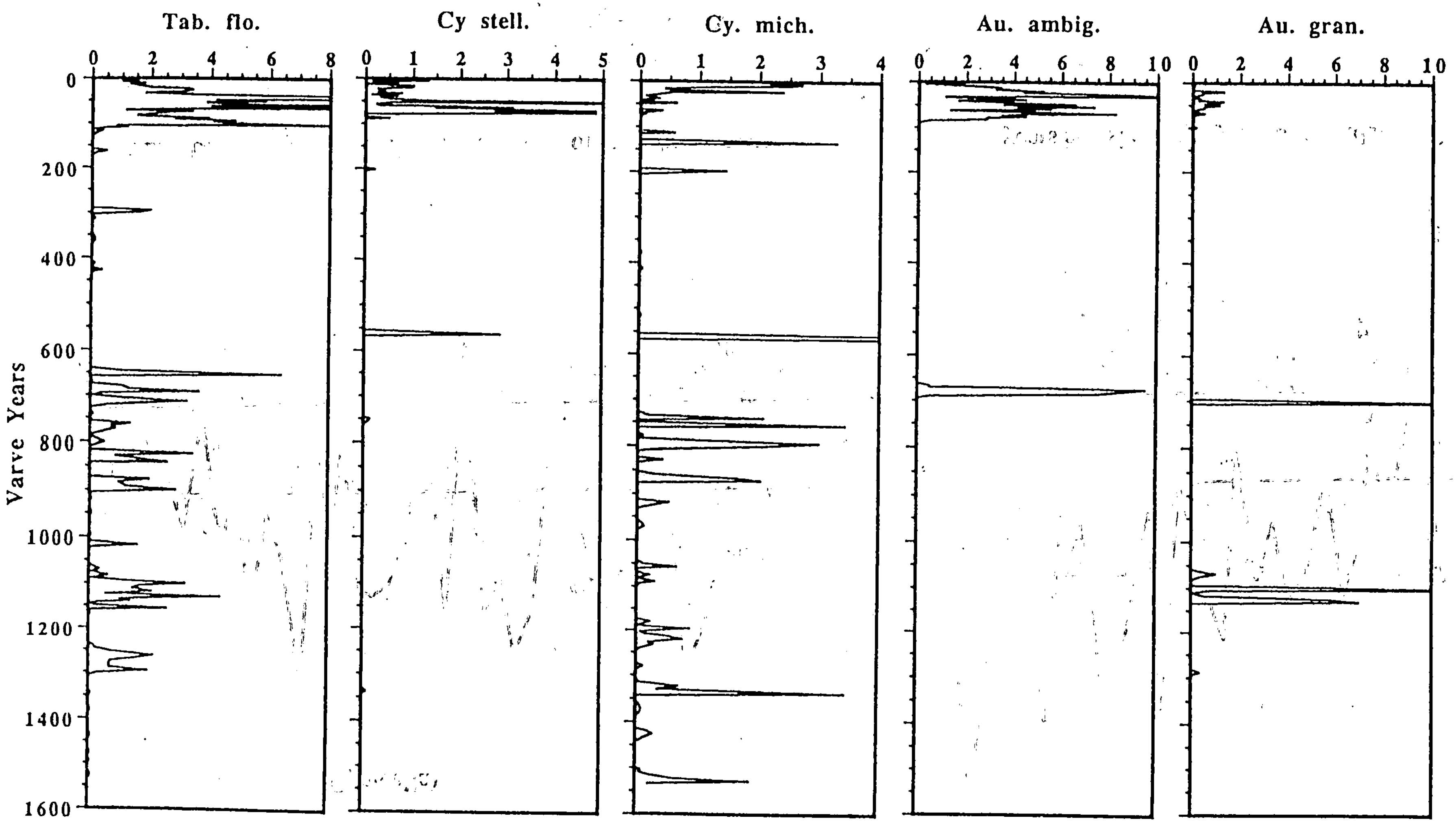

Figure 27. Profiles of concentrations (in numbers per mm of transect across a microscope slide) of the following planktic diatom species versus varve years for cores EL84B and EL83B-1: Tab. flo. = *Tabellaria flocculosa*; Cy. stell. *Cyclotella stelligera*; Cy. mich. = *Cyclotella michiganiana*; Au. ambig. = *Aulacoseira ambigua*; Au. gran. = *Aulacoseira granulata*

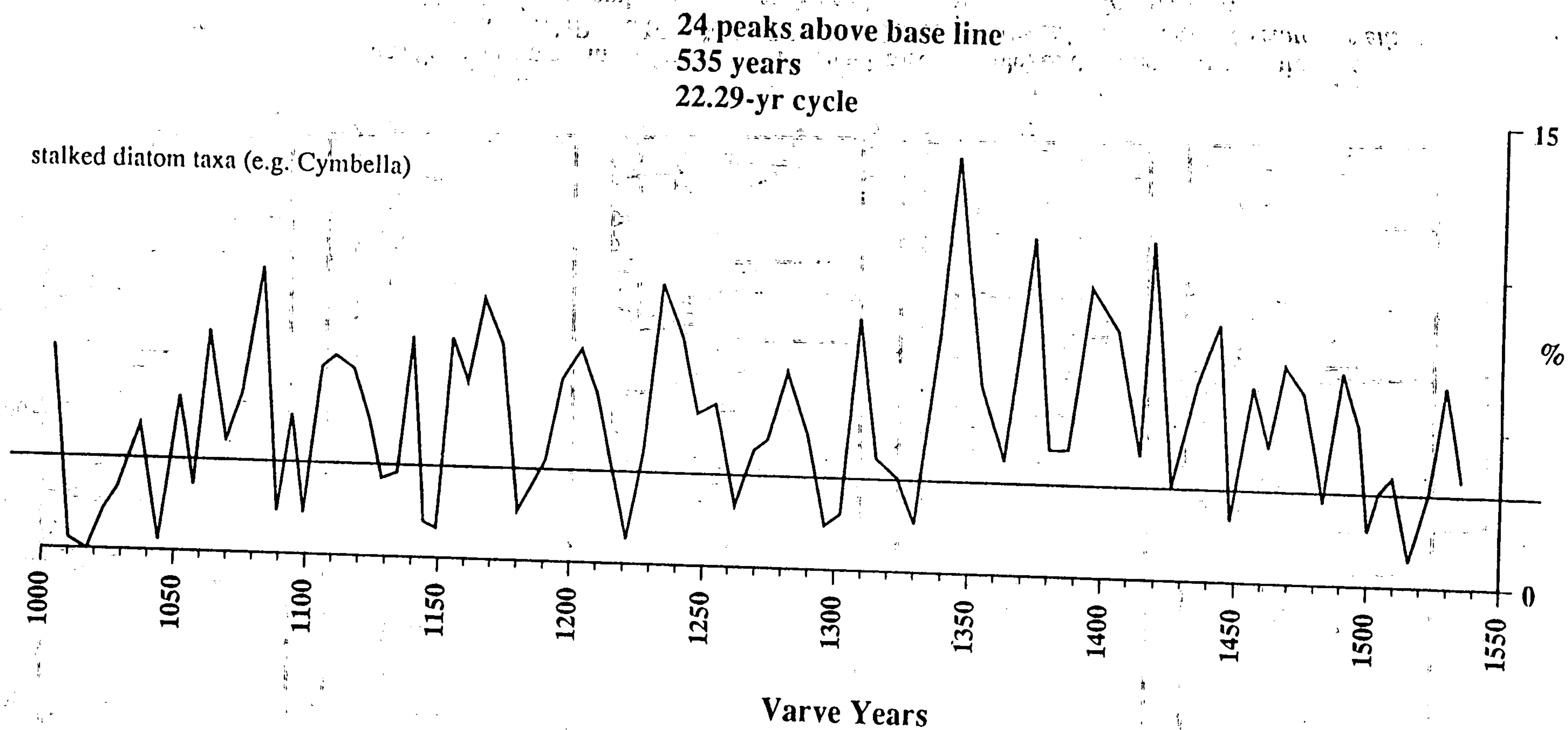

Figure 28. Distribution of *Cymbella* species (% of total diatoms) between 1000 and 1550 years ago showing cycles of abundance of ~22 years.

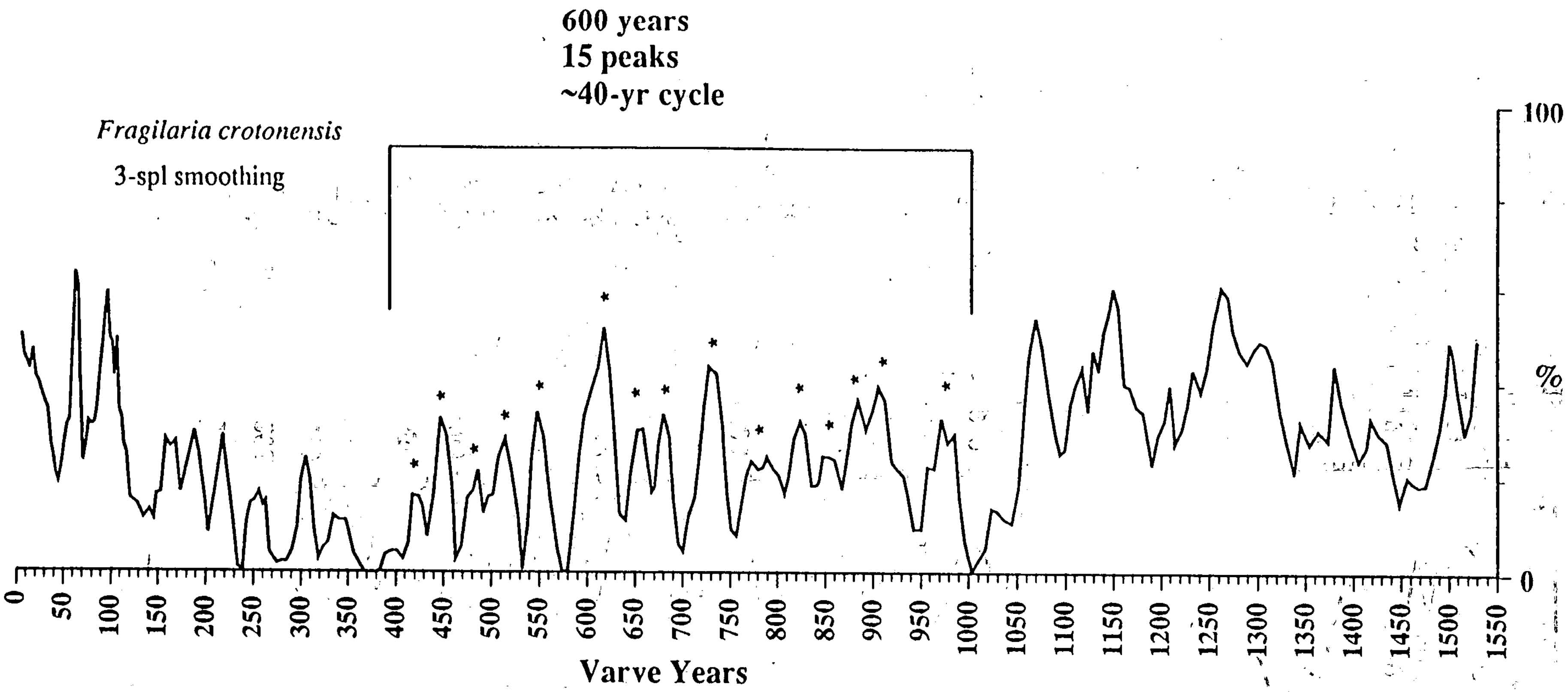

Figure 29. Distribution of *Fragilaria crotonensis* (% of total diatoms) between 400 and 1000 years ago showing cycles of abundance of ~40 years.

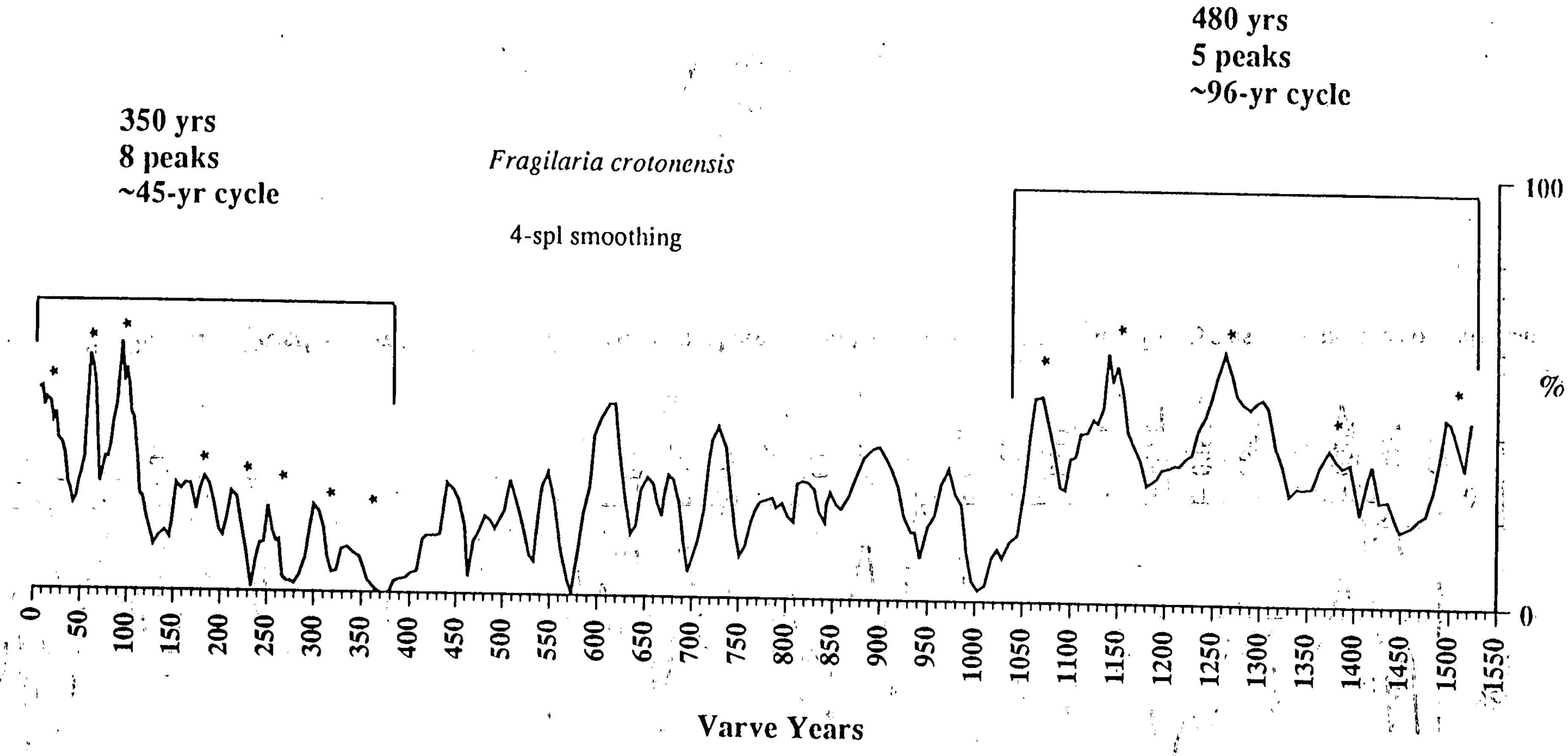

Figure 30. Distribution of *Fragilaria crotonensis* (% of total diatoms) showing cycles of abundance of ~45 and ~96-years between 0 and 350 and 1000 and 1550 years ago, respectively.

Cyclic Variations of Diatoms in Elk Lake for the Past 1550 Years

All profiles of diatom concentration show considerable variability, with most peaks and troughs of the profiles documented by several samples, typically two or three, that define a scale of temporal variation on the order of 22 years [see expanded plot of *Cymbella* species (Fig. 28)]. The ~22-year cycles group into longer cycles of ~40-45 and ~96 years (Figs. 29, 30) and longer, apparent cycles of several centuries' duration.

Diatom Paleolimnology of Elk Lake for the Past 1550 Years

Overall, the short-term variability of individual diatom species or genera is greater than long-term patterns of distribution, although there are some exceptions. For example, *Cyclotella bodanica*, *Cymbella* species and *Cocconeis placentula,* and, to a lesser extent, *Stephanodiscus alpinus* and *S. niagarae* all are more common between 1300 and 1550 years ago and after 100 years ago (Fig. 25). Both periods encompass times of high diatom production and a general dominance of *Fragilaria crotonensis* and *Asterionella formosa* relative to *Stephanodiscus minutulus* (Fig. 24). The distribution of *Cyclotella bodanica* implies strong (long?) summer stratification and dominance of *Fragilaria crotonensis* indicates weak or late spring circulation. The benthic diatoms, *Cymbella* species and *Cocconeis placentula*, may reflect deposition in the profundal region of Elk Lake after abundant growth in the littoral area during the summer. The abundance of *Asterionella formosa* suggests that late fall productivity of diatoms was high and implies vigorous fall circulation to supply phosphorus for *A. formosa* (Tilman and others, 1976).

The diatom paleolimnologic interpretation of a low wind regime during the spring and summer between 1300 and 1550 years ago parallels some geochemical data which suggest that there was strong stratification and high summer productivity (e.g. high iron, organic carbon, and phosphorus, and low carbonate; Fig. 18) during the same period. Many of the same diatoms characterize the past 100 years of Elk Lake history and likewise suggest that climates following the end of the Little Ice Age were also characterized by warm summers. Nevertheless, the impact of logging during the early part of the 20th Century on Elk Lake limnology has created important differences between the two periods. *Aulacoseira* species, which before the 20th Century were only sporadically abundant [1100 years ago (*A. granulata* only) and 700 years ago] characterized much of the last century (Fig. 27). These *Aulacoseira* species usually bloom during the summer and therefore require some mechanism to provide for their suspension in the photic zone by turbulence. Perhaps enhanced nutrient cycling and turbulence caused by log storage and removal on Elk Lake and flushing of nutrients into the lake that accompanied soil erosion from road building and log hauling allowed *Aulacoseira ambigua* and diatoms characteristic of eutrophic lakes such as *Stephanodiscus niagarae* to prosper (Figs. 25 and 27). The large number of phytoliths accumulating in Elk Lake during the first half of the 20th Century (Fig. 23) are probably a direct reflection of soil erosion related to logging.

Charcoal Analyses and Fire History Recorded by Elk Lake

The charcoal record for Elk Lake (Fig. 23), like the geochemical and diatom records reveals sharp, short-term fluctuations that are similar to those in charcoal records from nearby lakes in Itasca Park (Clark, 1993). Tree ring chronologies of fire-scared pines in the Elk Lake drainage indicate abundant fires in the late 18th and early 19th centuries (Spurr, 1954; Frissell, 1973) that may be reflected in the maximum charcoal concentrations recorded at that time in Elk Lake. Very low charcoal values beginning during the early 20th century (Fig. 23) reflect fire suppression accompanying settlement of the region.

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Appendix I: Varve thickness and gray-scale measurements for last 1500 years of the Elk Lake varved sediment record.

Core No.	Varve No.	Age yBP	Age AD	Gray-Scale (0 to 255)	Thickness (mm)	Cum. Thick. (mm)
EL84B	1	113	1871	172.31	3.42	3.42
EL84B	2	114	1870	182.60	1.58	5.00
EL84B	3	115	1869	183.92	2.00	7.00
EL84B	4	116	1868	185.41	1.67	8.67
EL84B	5	117	1867	167.86	2.08	10.75
EL84B	6	118	1866	175.99	2.00	12.75
EL84B	7	119	1865	175.90	2.17	14.92
EL84B	8	120	1864	179.62	1.92	16.84
EL84B	9	121	1863	174.64	1.33	18.17
EL84B	10	122	1862	180.20	2.08	20.25
EL84B	11	123	1861	192.41	1.17	21.42
EL84B	12	124	1860	181.69	1.67	23.09
EL84B	13	125	1859	185.21	1.83	24.92
EL84B	14	126	1858	183.27	1.58	26.50
EL84B	15	127	1857	184.11	1.58	28.09
EL84B	16	128	1856	180.16	0.83	28.92
EL84B	17	129	1855	166.34	1.50	30.42
EL84B	18	130	1854	178.00	2.00	32.42
EL84B	19	131	1853	171.83	2.50	34.92
EL84B	20	132	1852	173.29	2.00	36.92
EL84B	21	133	1851	161.69	1.75	38.67
EL84B	22	134	1850	148.59	2.08	40.75
EL84B	23	135	1849	162.14	1.83	42.59
EL84B	24	136	1848	143.26	1.25	43.84
EL84B	25	137	1847	152.73	1.42	45.25
EL84B	26	138	1846	166.11	1.83	47.09
EL84B	27	139	1845	142.03	1.33	48.42
EL84B	28	140	1844	163.49	2.00	50.42
EL84B	29	141	1843	165.70	1.83	52.25
EL84B	30	142	1842	160.85	2.00	54.25
EL84B	31	143	1841	150.01	1.67	55.92
EL84B	32	144	1840	169.81	2.17	58.09
EL84B	33	145	1839	160.45	2.50	60.59
EL84B	34	146	1838	140.93	3.33	63.92
EL84B	35	147	1837	167.92	3.42	67.34
EL84B	36	148	1836	169.85	2.25	69.59
EL84B	37	149	1835	162.71	2.25	71.84
EL84B	38	150	1834	170.34	2.33	74.17
EL84B	39	151	1833	161.30	3.17	77.34
EL84B	40	152	1832	152.12	2.42	79.75
EL84B	41	153	1831	171.67	2.25	82.00
EL84B	42	154	1830	179.37	1.67	83.67
EL84B	43	155	1829	173.62	1.92	85.59
EL84B	44	156	1828	171.35	1.58	87.17
EL84B	45	157	1827	159.75	1.92	89.09
EL84B	46	158	1826	151.28	1.67	90.75
EL84B	47	159	1825	148.40	2.00	92.75
EL84B	48	160	1824	157.45	2.16	94.92
EL84B	49	161	1823	145.84	2.25	97.17
EL84B	50	162	1822	145.30	1.75	98.92
EL84B	51	163	1821	157.40	1.67	100.58
EL84B	52	164	1820	128.55	1.67	102.25
EL84B	53	165	1819	150.92	1.67	103.92

Appendix I: Varve thickness and gray-scale measurements for last 1500 years of the Elk Lake varved sediment record.

Core No.	Varve No.	Age yBP	Age AD	Gray- Scale (0 to 255)	Thickness (mm)	Cum. Thick. (mm)
EL84B	54	166	1818	150.18	2.00	105.92
EL84B	55	167	1817	146.87	1.58	107.50
EL84B	56	168	1816	171.04	1.58	109.08
EL84B	57	169	1815	157.14	1.00	110.08
EL84B	58	170	1814	161.52	2.08	112.17
EL84B	59	171	1813	143.90	1.00	113.17
EL84B	60	172	1812	146.80	1.33	114.50
EL84B	61	173	1811	175.28	2.08	116.58
EL84B	62	174	1810	173.11	2.67	119.25
EL84B	63	175	1809	151.45	1.67	120.92
EL84B	64	176	1808	163.16	2.00	122.92
EL84B	65	177	1807	174.63	2.25	125.17
EL84B	66	178	1806	153.74	1.83	127.00
EL84B	67	179	1805	153.36	1.75	128.75
EL84B	68	180	1804	156.51	2.67	131.42
EL84B	69	181	1803	166.12	2.17	133.58
EL84B	70	182	1802	157.93	1.58	135.17
EL84B	71	183	1801	170.90	2.00	137.17
EL84B	72	184	1800	167.42	2.17	139.33
EL84B	73	185	1799	161.95	1.42	140.75
EL84B	74	186	1798	167.60	2.33	143.08
EL84B	75	187	1797	159.06	1.92	145.00
EL84B	76	188	1796	167.84	1.83	146.83
EL84B	77	189	1795	164.93	1.75	148.58
EL84B	78	190	1794	158.62	2.67	151.25
EL84B	79	191	1793	163.71	2.00	153.25
EL84B	80	192	1792	163.32	2.00	155.25
EL84B	81	193	1791	144.08	2.42	157.67
EL84B	82	194	1790	150.78	2.25	159.92
EL84B	83	195	1789	145.19	2.00	161.92
EL84B	84	196	1788	154.30	2.67	164.58
EL84B	85	197	1787	154.30	1.75	166.33
EL84B	86	198	1786	167.70	1.33	167.67
EL84B	87	199	1785	164.27	2.17	169.83
EL84B	88	200	1784	163.21	2.17	172.00
EL84B	89	201	1783	165.60	2.33	174.33
EL84B	90	202	1782	169.11	2.42	176.75
EL84B	91	203	1781	161.88	2.50	179.25
EL84B	92	204	1780	171.96	1.83	181.08
EL84B	93	205	1779	146.00	1.58	182.67
EL84B	94	206	1778	150.04	1.92	184.58
EL84B	95	207	1777	162.78	1.92	186.50
EL84B	96	208	1776	171.11	1.50	188.00
EL84B	97	209	1775	162.38	2.42	190.42
EL84B	98	210	1774	174.10	1.75	192.17
EL84B	99	211	1773	175.01	1.67	193.83
EL84B	100	212	1772	163.86	2.42	196.25
EL84B	101	213	1771	169.00	1.92	198.17
EL84B	102	214	1770	178.36	1.66	199.83
EL84B	103	215	1769	169.84	2.25	202.08
EL84B	104	216	1768	158.26	1.58	203.66
EL84B	105	217	1767	164.18	2.08	205.75
EL84B	106	218	1766	148.65	2.08	207.83

Appendix I: Varve thickness and gray-scale measurements for last 1500 years of the Elk Lake varved sediment record.

Core No.	Varve No.	Age yBP	Age AD	Gray-Scale (0 to 255)	Thickness (mm)	Cum. Thick. (mm)
EL84B	107	219	1765	155.28	2.25	210.08
EL84B	108	220	1764	163.78	1.42	211.50
EL84B	109	221	1763	159.37	1.58	213.08
EL84B	110	222	1762	153.42	2.17	215.25
EL84B	111	223	1761	151.04	2.00	217.25
EL84B	112	224	1760	148.29	2.25	219.50
EL84B	113	225	1759	151.32	1.92	221.41
EL84B	114	226	1758	130.60	1.92	223.33
EL84B	115	227	1757	122.64	2.92	226.25
EL84B	116	228	1756	149.52	2.33	228.58
EL84B	117	229	1755	150.69	1.75	230.33
EL84B	118	230	1754	161.36	1.67	232.00
EL84B	119	231	1753	154.46	1.67	233.66
EL84B	120	232	1752	165.89	1.00	234.66
EL84B	121	233	1751	154.32	1.67	236.33
EL84B	122	234	1750	163.13	1.58	237.91
EL84B	123	235	1749	154.66	1.58	239.50
EL84B	124	236	1748	158.02	2.67	242.16
EL84B	125	237	1747	164.84	2.67	244.83
EL84B	126	238	1746	162.39	2.25	247.08
EL84B	127	239	1745	156.30	2.67	249.75
EL84B	128	240	1744	160.78	1.83	251.58
EL84B	129	241	1743	149.15	2.25	253.83
EL84B	130	242	1742	161.50	1.58	255.41
EL84B	131	243	1741	148.61	4.33	259.75
EL84B	132	244	1740	141.46	2.25	262.00
EL84B	133	245	1739	152.33	2.58	264.58
EL84B	134	246	1738	142.09	2.67	267.25
EL84B	135	247	1737	147.29	2.83	270.08
EL84B	136	248	1736	147.14	2.08	272.16
EL84B	137	249	1735	153.14	2.83	275.00
EL84B	138	250	1734	147.91	2.75	277.75
EL84B	139	251	1733	154.41	2.58	280.33
EL84B	140	252	1732	161.08	2.42	282.75
EL84B	141	253	1731	164.00	2.17	284.91
EL84B	142	254	1730	160.62	1.83	286.75
EL84B	143	255	1729	175.51	2.42	289.16
EL84B	144	256	1728	165.47	2.83	291.99
EL84B	145	257	1727	154.26	2.00	293.99
EL84B	146	258	1726	135.29	2.08	296.08
EL84B	147	259	1725	156.01	2.33	298.41
EL84B	148	260	1724	141.71	2.33	300.74
EL84B	149	261	1723	147.85	2.75	303.49
EL84B	150	262	1722	121.66	2.17	305.66
EL84B	151	263	1721	137.18	2.75	308.41
EL84B	152	264	1720	146.48	2.67	311.08
EL84B	153	265	1719	142.43	1.83	312.91
EL84B	154	266	1718	143.47	2.75	315.66
EL84B	155	267	1717	128.75	3.42	319.08
EL84B	156	268	1716	116.78	2.00	321.08
EL84B	157	269	1715	127.59	2.25	323.33
EL84B	158	270	1714	141.51	2.08	325.41
EL84B	159	271	1713	137.99	3.00	328.41

Appendix I: Varve thickness and gray-scale measurements for last 1500 years of the Elk Lake varved sediment record.

Core No.	Varve No.	Age yBP	Age AD	Gray- Scale (0 to 255)	Thickness (mm)	Cum. Thick. (mm)
EL84B	160	272	1712	167.45	2.50	330.91
EL84B	161	273	1711	140.23	1.67	332.58
EL84B	162	274	1710	154.83	1.58	334.16
EL84B	163	275	1709	156.48	2.42	336.58
EL84B	164	276	1708	149.95	2.58	339.16
EL84B	165	277	1707	160.90	2.33	341.49
EL84B	166	278	1706	167.98	1.75	343.24
EL84B	167	279	1705	168.94	2.08	345.33
EL84B	168	280	1704	154.90	2.67	347.99
EL84B	169	281	1703	174.32	2.17	350.16
EL84B	170	282	1702	173.70	2.50	352.66
EL84B	171	283	1701	169.44	0.75	353.41
EL84B	172	284	1700	164.51	2.25	355.66
EL84B	173	285	1699	167.49	2.17	357.83
EL84B	174	286	1698	162.45	3.17	360.99
EL84B	175	287	1697	158.96	2.08	363.08
EL84B	176	288	1696	162.02	1.67	364.74
EL84B	177	289	1695	163.81	1.67	366.41
EL84B	178	290	1694	162.02	1.50	367.91
EL84B	179	291	1693	159.16	1.58	369.49
EL84B	180	292	1692	156.64	1.42	370.91
EL84B	181	293	1691	162.59	2.58	373.49
EL84B	182	294	1690	125.03	3.42	376.91
EL84B	183	295	1689	152.02	2.92	379.83
EL84B	184	296	1688	154.97	3.83	383.66
EL84B	185	297	1687	143.12	3.33	386.99
EL84B	186	298	1686	150.68	2.50	389.49
EL84B	187	299	1685	150.54	2.17	391.66
EL84B	188	300	1684	148.96	3.00	394.66
EL84B	189	301	1683	150.97	2.42	397.07
EL84B	190	302	1682	159.32	2.67	399.74
EL84B	191	303	1681	157.77	2.50	402.24
EL84B	192	304	1680	156.42	1.67	403.91
EL84B	193	305	1679	157.99	2.58	406.49
EL84B	194	306	1678	151.85	2.08	408.57
EL84B	195	307	1677	173.66	1.67	410.24
EL84B	196	308	1676	144.67	2.17	412.41
EL84B	197	309	1675	162.27	1.83	414.24
EL84B	198	310	1674	164.55	1.92	416.16
EL84B	199	311	1673	169.14	2.42	418.57
EL84B	200	312	1672	175.11	1.92	420.49
EL84B	201	313	1671	147.93	1.92	422.41
EL84B	202	314	1670	149.44	2.08	424.49
EL84B	203	315	1669	116.13	2.08	426.57
EL84B	204	316	1668	130.03	2.50	429.07
EL84B	205	317	1667	132.20	2.33	431.41
EL84B	206	318	1666	124.98	3.08	434.49
EL84B	207	319	1665	139.30	2.00	436.49
EL84B	208	320	1664	158.14	2.08	438.57
EL84B	209	321	1663	154.04	2.08	440.66
EL84B	210	322	1662	161.88	1.75	442.41
EL84B	211	323	1661	149.21	2.17	444.57
EL84B	212	324	1660	143.60	1.67	446.24

Appendix I: Varve thickness and gray-scale measurements for last 1500 years of the Elk Lake varved sediment record.

Core No.	Varve No.	Age yBP	Age AD	Gray-Scale (0 to 255)	Thickness (mm)	Cum. Thick. (mm)
EL84B	213	325	1659	158.33	1.50	447.74
EL84B	214	326	1658	172.25	1.92	449.66
EL84B	215	327	1657	167.07	1.67	451.32
EL84B	216	328	1656	167.37	2.17	453.49
EL84B	217	329	1655	173.47	1.08	454.57
EL84B	218	330	1654	169.20	1.33	455.91
EL84B	219	331	1653	156.47	2.17	458.07
EL84B	220	332	1652	147.90	1.75	459.82
EL84B	221	333	1651	160.61	2.00	461.82
EL84B	222	334	1650	149.94	1.83	463.66
EL84B	223	335	1649	170.19	1.42	465.07
EL84B	224	336	1648	171.80	1.00	466.07
EL84B	225	337	1647	176.97	0.92	466.99
EL84B	226	338	1646	166.10	1.50	468.49
EL84B	227	339	1645	169.98	1.08	469.57
EL84B	228	340	1644	173.51	1.33	470.90
EL84B	229	341	1643	178.27	1.75	472.65
EL84B	230	342	1642	167.27	2.25	474.90
EL84B	231	343	1641	164.57	1.50	476.40
EL84B	232	344	1640	167.14	1.83	478.24
EL84B	233	345	1639	151.42	1.67	479.90
EL84B	234	346	1638	162.99	1.17	481.07
EL84B	235	347	1637	167.59	1.08	482.15
EL84B	236	348	1636	171.92	1.42	483.57
EL84B	237	349	1635	155.51	1.33	484.90
EL84B	238	350	1634	141.67	1.58	486.49
EL84B	239	351	1633	146.83	1.33	487.82
EL84B	240	352	1632	155.90	1.50	489.32
EL84B	241	353	1631	154.86	1.17	490.49
EL84B	242	354	1630	159.39	1.50	491.99
EL84B	243	355	1629	137.43	1.58	493.57
EL84B	244	356	1628	154.38	1.25	494.82
EL84B	245	357	1627	166.52	1.58	496.40
EL84B	246	358	1626	168.67	2.00	498.40
EL84B	247	359	1625	157.59	2.17	500.57
EL84B	248	360	1624	170.43	1.83	502.40
EL84B	249	361	1623	166.94	1.50	503.90
EL84B	250	362	1622	174.11	1.83	505.74
EL84B	251	363	1621	164.78	1.25	506.99
EL84B	252	364	1620	166.17	2.25	509.24
EL84B	253	365	1619	156.05	1.25	510.49
EL84B	254	366	1618	152.75	1.83	512.32
EL84B	255	367	1617	153.61	2.50	514.82
EL84B	256	368	1616	167.22	3.83	518.65
EL84B	257	369	1615	155.72	3.25	521.90
EL84B	258	370	1614	168.73	1.33	523.24
EL84B	259	371	1613	159.05	1.75	524.99
EL84B	260	372	1612	173.18	1.83	526.82
EL84B	261	373	1611	164.93	0.92	527.74
EL84B	262	374	1610	156.09	1.00	528.74
EL84B	263	375	1609	159.52	1.17	529.90
EL84B	264	376	1608	151.07	1.17	531.07
EL84B	265	377	1607	149.40	1.83	532.90

Appendix I: Varve thickness and gray-scale measurements for last 1500 years of the Elk Lake varved sediment record.

Core No.	Varve No.	Age yBP	Age AD	Gray-Scale (0 to 255)	Thickness (mm)	Cum. Thick. (mm)
EL84B	266	378	1606	159.15	1.58	534.49
EL84B	267	379	1605	151.34	3.75	538.24
EL84B	268	380	1604	149.59	2.08	540.32
EL84B	269	381	1603	151.84	1.42	541.74
EL84B	270	382	1602	152.71	1.92	543.65
EL84B	271	383	1601	152.88	1.67	545.32
EL84B	272	384	1600	144.07	2.00	547.32
EL84B	273	385	1599	137.89	1.92	549.24
EL84B	274	386	1598	119.26	2.17	551.40
EL84B	275	387	1597	130.18	1.58	552.99
EL84B	276	388	1596	143.57	2.00	554.99
EL84B	277	389	1595	142.43	1.75	556.74
EL84B	278	390	1594	140.61	1.25	557.99
EL84B	279	391	1593	156.55	1.50	559.49
EL84B	280	392	1592	143.89	1.67	561.15
EL84B	281	393	1591	119.86	1.50	562.65
EL84B	282	394	1590	150.87	1.33	563.99
EL84B	283	395	1589	157.81	1.33	565.32
EL84B	284	396	1588	161.22	1.42	566.74
EL84B	285	397	1587	155.09	1.58	568.32
EL84B	286	398	1586	152.02	1.75	570.07
EL84B	287	399	1585	164.25	1.83	571.90
EL84B	288	400	1584	146.73	2.08	573.99
EL84B	289	401	1583	164.04	2.04	576.03
EL84B	290	402	1582	165.41	0.80	576.83
EL84B	291	403	1581	182.98	1.60	578.43
EL84B	292	404	1580	177.28	1.73	580.16
EL84B	293	405	1579	168.41	1.47	581.63
EL84B	294	406	1578	164.79	1.47	583.10
EL84B	295	407	1577	168.98	2.00	585.10
EL84B	296	408	1576	155.79	2.67	587.76
EL84B	297	409	1575	155.36	1.60	589.36
EL84B	298	410	1574	151.09	2.13	591.50
EL84B	299	411	1573	166.99	1.60	593.10
EL84B	300	412	1572	169.28	1.60	594.70
EL84B	301	413	1571	158.73	1.47	596.16
EL84B	302	414	1570	185.20	1.33	597.50
EL84B	303	415	1569	151.22	2.13	599.63
EL84B	304	416	1568	166.56	3.07	602.70
EL84B	305	417	1567	126.92	2.40	605.10
EL84B	306	418	1566	167.89	1.47	606.56
EL84B	307	419	1565	122.21	1.47	608.03
EL84B	308	420	1564	150.31	1.87	609.90
EL84B	309	421	1563	134.12	1.60	611.50
EL84B	310	422	1562	145.77	2.27	613.76
EL84B	311	423	1561	146.38	1.73	615.50
EL84B	312	424	1560	161.68	1.87	617.36
EL84B	313	425	1559	168.97	1.60	618.96
EL84B	314	426	1558	143.86	4.00	622.96
EL84B	315	427	1557	148.62	2.53	625.50
EL84B	316	428	1556	144.07	1.73	627.23
EL84B	317	429	1555	169.01	2.00	629.23
EL84B	318	430	1554	178.74	1.73	630.96

Appendix I: Varve thickness and gray-scale measurements for last 1500 years of the Elk Lake varved sediment record.

Core No.	Varve No.	Age yBP	Age AD	Gray- Scale (0 to 255)	Thickness (mm)	Cum. Thick. (mm)
EL84B	319	431	1553	165.47	0.09	631.06
EL84B	320	432	1552	144.51	0.08	631.14
EL84B	321	433	1551	162.21	0.12	631.26
EL84B	322	434	1550	139.47	1.33	632.59
EL84B	323	435	1549	152.44	1.60	634.19
EL84B	324	436	1548	160.02	3.33	637.52
EL84B	325	437	1547	152.35	0.80	638.32
EL84B	326	438	1546	141.85	0.80	639.12
EL84B	327	439	1545	136.45	0.93	640.06
EL84B	328	440	1544	121.09	1.20	641.26
EL84B	329	441	1543	129.07	1.33	642.59
EL84B	330	442	1542	126.70	1.87	644.46
EL84B	331	443	1541	132.33	2.00	646.46
EL84B	332	444	1540	150.99	1.87	648.32
EL84B	333	445	1539	182.62	2.53	650.86
EL84B	334	446	1538	139.70	1.87	652.72
EL84B	335	447	1537	128.31	1.47	654.19
EL84B	336	448	1536	169.13	1.20	655.39
EL84B	337	449	1535	182.48	1.60	656.99
EL84B	338	450	1534	180.47	1.60	658.59
EL84B	339	451	1533	140.78	1.60	660.19
EL84B	340	452	1532	160.74	1.66	661.85
EL84B	341	453	1531	172.31	1.25	663.10
EL84B	342	454	1530	182.60	1.92	665.02
EL84B	343	455	1529	183.92	1.92	666.94
EL84B	344	456	1528	185.41	1.67	668.60
EL84B	345	457	1527	167.86	2.17	670.77
EL84B	346	458	1526	175.99	1.75	672.52
EL84B	347	459	1525	175.90	2.33	674.85
EL84B	348	460	1524	179.62	1.83	676.69
EL84B	349	461	1523	174.64	1.67	678.35
EL84B	350	462	1522	180.20	2.17	680.52
EL84B	351	463	1521	192.41	2.08	682.60
EL84B	352	464	1520	181.69	1.83	684.44
EL84B	353	465	1519	185.21	1.58	686.02
EL84B	354	466	1518	183.27	1.83	687.85
EL84B	355	467	1517	184.11	2.00	689.85
EL84B	356	468	1516	180.16	1.83	691.69
EL84B	357	469	1515	166.34	1.42	693.10
EL84B	358	470	1514	178.00	1.67	694.77
EL84B	359	471	1513	171.83	1.50	696.27
EL84B	360	472	1512	173.29	0.75	697.02
EL84B	361	473	1511	161.69	0.92	697.94
EL84B	362	474	1510	148.59	1.92	699.85
EL84B	363	475	1509	162.14	1.75	701.60
EL84B	364	476	1508	143.26	1.50	703.10
EL84B	365	477	1507	152.73	1.67	704.77
EL84B	366	478	1506	166.11	2.17	706.94
EL84B	367	479	1505	142.03	1.83	708.77
EL84B	368	480	1504	163.49	2.50	711.27
EL84B	369	481	1503	165.70	2.25	713.52
EL84B	370	482	1502	160.85	2.00	715.52
EL84B	371	483	1501	150.01	1.83	717.35

Appendix I: Varve thickness and gray-scale measurements for last 1500 years of the Elk Lake varved sediment record.

Core No.	Varve No.	Age yBP	Age AD	Gray-Scale (0 to 255)	Thickness (mm)	Cum. Thick. (mm)
EL84B	372	484	1500	169.81	1.58	718.94
EL84B	373	485	1499	160.45	1.92	720.85
EL84B	374	486	1498	140.93	2.00	722.85
EL84B	375	487	1497	167.92	1.75	724.60
EL84B	376	488	1496	169.85	1.67	726.27
EL84B	377	489	1495	162.71	1.67	727.94
EL84B	378	490	1494	170.34	2.00	729.94
EL84B	379	491	1493	161.30	2.33	732.27
EL84B	380	492	1492	152.12	1.42	733.69
EL84B	381	493	1491	171.67	1.50	735.19
EL84B	382	494	1490	179.37	1.92	737.10
EL84B	383	495	1489	173.62	1.58	738.69
EL84B	384	496	1488	171.35	2.00	740.69
EL84B	385	497	1487	159.75	1.92	742.60
EL84B	386	498	1486	151.28	2.00	744.60
EL84B	387	499	1485	148.40	1.83	746.44
EL84B	388	500	1484	172.22	2.00	748.44
EL84B	389	501	1483	147.22	2.50	750.94
EL84B	390	502	1482	163.45	1.67	752.60
EL84B	391	503	1481	160.81	1.83	754.44
EL84B	392	504	1480	159.42	1.50	755.94
EL84B	393	505	1479	174.80	1.83	757.77
EL84B	394	506	1478	171.32	1.83	759.60
EL84B	395	507	1477	171.42	2.17	761.77
EL84B	396	508	1476	165.29	1.67	763.44
EL84B	397	509	1475	164.64	1.17	764.60
EL84B	398	510	1474	174.84	1.50	766.10
EL84B	399	511	1473	174.57	1.00	767.10
EL84B	400	512	1472	166.54	1.83	768.94
EL84B	401	513	1471	167.19	1.50	770.44
EL84B	402	514	1470	172.14	1.67	772.10
EL84B	403	515	1469	176.94	1.50	773.60
EL84B	404	516	1468	172.86	1.33	774.94
EL84B	405	517	1467	161.47	1.33	776.27
EL84B	406	518	1466	159.94	1.33	777.60
EL84B	407	519	1465	161.58	0.83	778.44
EL84B	408	520	1464	158.45	1.17	779.60
EL84B	409	521	1463	166.53	1.33	780.94
EL84B	410	522	1462	144.00	1.50	782.44
EL84B	411	523	1461	143.28	1.67	784.10
EL84B	412	524	1460	146.08	1.50	785.60
EL84B	413	525	1459	156.12	1.50	787.10
EL84B	414	526	1458	140.29	2.17	789.27
EL84B	415	527	1457	116.46	1.67	790.94
EL84B	416	528	1456	103.60	1.33	792.27
EL84B	417	529	1455	156.57	2.17	794.44
EL84B	418	530	1454	163.06	1.67	796.10
EL84B	419	531	1453	140.03	3.17	799.27
EL84B	420	532	1452	151.86	2.33	801.60
EL84B	421	533	1451	159.41	2.00	803.60
EL84B	422	534	1450	167.01	1.83	805.44
EL84B	423	535	1449	169.38	2.17	807.60
EL84B	424	536	1448	170.58	2.33	809.94

Appendix I: Varve thickness and gray-scale measurements for last 1500 years of the Elk Lake varved sediment record.

Core No.	Varve No.	Age yBP	Age AD	Gray-Scale (0 to 255)	Thickness (mm)	Cum. Thick. (mm)
EL84B	425	537	1447	156.56	2.00	811.94
EL84B	426	538	1446	164.08	1.50	813.44
EL84B	427	539	1445	169.53	2.17	815.60
EL84B	428	540	1444	159.91	2.33	817.94
EL84B	429	541	1443	145.10	2.50	820.44
EL84B	430	542	1442	135.31	1.66	822.10
EL84B	431	543	1441	154.12	2.00	824.10
EL84B	432	544	1440	172.55	0.67	824.76
EL84B	433	545	1439	168.57	1.33	826.10
EL84B	434	546	1438	166.62	1.33	827.43
EL84B	435	547	1437	162.03	1.33	828.76
EL84B	436	548	1436	167.55	1.33	830.10
EL84B	437	549	1435	157.97	1.50	831.60
EL84B	438	550	1434	163.58	1.83	833.43
EL84B	439	551	1433	168.48	1.58	835.01
EL84B	440	552	1432	159.71	1.67	836.68
EL84B	441	553	1431	147.92	1.00	837.68
EL84B	442	554	1430	147.63	1.67	839.35
EL84B	443	555	1429	149.23	1.75	841.10
EL84B	444	556	1428	159.43	1.00	842.10
EL84B	445	557	1427	154.57	1.42	843.51
EL84B	446	558	1426	170.10	1.33	844.85
EL84B	447	559	1425	173.15	1.25	846.10
EL84B	448	560	1424	175.74	1.25	847.35
EL84B	449	561	1423	174.93	1.83	849.18
EL84B	450	562	1422	168.99	1.58	850.76
EL84B	451	563	1421	160.17	1.50	852.26
EL84B	452	564	1420	154.83	2.58	854.85
EL84B	453	565	1419	152.64	1.33	856.18
EL84B	454	566	1418	157.10	2.00	858.18
EL84B	455	567	1417	154.90	2.25	860.43
EL84B	456	568	1416	156.62	1.92	862.35
EL84B	457	569	1415	150.57	1.25	863.60
EL84B	458	570	1414	162.60	1.75	865.35
EL84B	459	571	1413	160.05	2.00	867.35
EL84B	460	572	1412	150.37	2.00	869.35
EL84B	461	573	1411	166.64	1.58	870.93
EL84B	462	574	1410	165.33	0.00	870.93
EL84B	463	575	1409	145.56	2.00	872.93
EL84B	464	576	1408	154.03	2.08	875.01
EL84B	465	577	1407	165.33	2.42	877.43
EL84B	466	578	1406	162.71	1.67	879.10
EL84B	467	579	1405	165.08	1.75	880.85
EL84B	468	580	1404	159.45	2.25	883.10
EL84B	469	581	1403	155.41	1.50	884.60
EL84B	470	582	1402	152.36	1.75	886.35
EL84B	471	583	1401	155.01	1.58	887.93
EL84B	472	584	1400	165.30	1.75	889.68
EL84B	473	585	1399	172.68	1.42	891.10
EL84B	474	586	1398	171.67	1.58	892.68
EL84B	475	587	1397	177.01	2.17	894.85
EL84B	476	588	1396	177.32	0.83	895.68
EL84B	477	589	1395	169.55	1.08	896.76

Appendix I: Varve thickness and gray-scale measurements for last 1500 years of the Elk Lake varved sediment record.

Core No.	Varve No.	Age yBP	Age AD	Gray- Scale (0 to 255)	Thickness (mm)	Cum. Thick. (mm)
EL84B	478	590	1394	167.00	2.17	898.93
EL84B	479	591	1393	168.33	1.58	900.51
EL84B	480	592	1392	159.79	1.50	902.01
EL84B	481	593	1391	166.58	1.75	903.76
EL84B	482	594	1390	152.37	2.00	905.76
EL84B	483	595	1389	154.19	1.67	907.43
EL84B	484	596	1388	149.64	1.42	908.85
EL84B	485	597	1387	159.11	2.17	911.01
EL84B	486	598	1386	151.21	2.00	913.01
EL84B	487	599	1385	148.85	2.08	915.10
EL84B	488	600	1384	162.32	1.75	916.85
EL84B	489	601	1383	165.76	1.08	917.93
EL84B	490	602	1382	162.63	1.08	919.01
EL84B	491	603	1381	157.95	1.00	920.01
EL84B	492	604	1380	157.84	1.25	921.26
EL84B	493	605	1379	163.57	1.83	923.10
EL84B	494	606	1378	171.94	1.08	924.18
EL84B	495	607	1377	170.08	0.75	924.93
EL84B	496	608	1376	171.42	0.67	925.60
EL84B	497	609	1375	168.63	1.00	926.60
EL84B	498	610	1374	158.07	1.83	928.43
EL84B	499	611	1373	163.32	1.08	929.51
EL84B	500	612	1372	154.53	1.25	930.76
EL84B	501	613	1371	164.53	1.67	932.43
EL84B	502	614	1370	155.35	1.75	934.18
EL84B	503	615	1369	142.02	1.75	935.93
EL84B	504	616	1368	156.11	1.58	937.51
EL84B	505	617	1367	144.52	2.17	939.68
EL84B	506	618	1366	150.88	2.17	941.84
EL84B	507	619	1365	142.62	1.33	943.18
EL84B	508	620	1364	140.85	0.75	943.93
EL84B	509	621	1363	140.42	0.83	944.76
EL84B	510	622	1362	144.88	0.83	945.59
EL84B	511	623	1361	151.95	1.42	947.01
EL84B	512	624	1360	161.74	2.08	949.09
EL84B	513	625	1359	153.19	1.50	950.59
EL84B	514	626	1358	151.84	2.50	953.09
EL84B	515	627	1357	140.18	2.83	955.93
EL84B	516	628	1356	141.05	1.83	957.76
EL84B	517	629	1355	160.10	2.25	960.01
EL84B	518	630	1354	166.17	2.42	962.43
EL84B	519	631	1353	160.02	1.83	964.26
EL84B	520	632	1352	169.28	1.83	966.09
EL84B	521	633	1351	148.00	2.42	968.51
EL84B	522	634	1350	150.84	2.25	970.76
EL84B	523	635	1349	160.40	2.33	973.09
EL84B	524	636	1348	163.51	1.92	975.01
EL84B	525	637	1347	165.48	1.75	976.76
EL84B	526	638	1346	151.99	1.50	978.26
EL84B	527	639	1345	162.49	1.92	980.18
EL84B	528	640	1344	169.61	2.67	982.84
EL84B	529	641	1343	152.61	1.83	984.68
EL84B	530	642	1342	164.55	1.17	985.84

Appendix I: Varve thickness and gray-scale measurements for last 1500 years of the Elk Lake varved sediment record.

Core No.	Varve No.	Age yBP	Age AD	Gray- Scale (0 to 255)	Thickness (mm)	Cum. Thick. (mm)
EL84B	531	643	1341	153.34	1.08	986.93
EL84B	532	644	1340	155.76	0.83	987.76
EL84B	533	645	1339	161.26	1.17	988.93
EL84B	534	646	1338	154.37	1.67	990.59
EL84B	535	647	1337	159.75	1.58	992.18
EL84B	536	648	1336	166.14	0.67	992.84
EL84B	537	649	1335	176.82	1.42	994.26
EL84B	538	650	1334	163.82	1.00	995.26
EL84B	539	651	1333	150.79	1.25	996.51
EL84B	540	652	1332	157.62	1.50	998.01
EL84B	541	653	1331	179.86	2.00	1000.01
EL84B	542	654	1330	148.94	2.67	1002.68
EL84B	543	655	1329	163.18	2.92	1005.59
EL84B	544	656	1328	155.49	2.83	1008.43
EL84B	545	657	1327	149.18	1.83	1010.26
EL84B	546	658	1326	144.28	2.17	1012.42
EL84B	547	659	1325	162.02	2.17	1014.59
EL84B	548	660	1324	142.75	2.17	1016.76
EL84B	549	661	1323	157.71	2.00	1018.76
EL84B	550	662	1322	151.86	2.08	1020.84
EL84B	551	663	1321	142.24	2.58	1023.42
EL84B	552	664	1320	143.92	2.25	1025.67
EL84B	553	665	1319	126.37	2.50	1028.17
EL84B	554	666	1318	129.45	2.92	1031.09
EL84B	555	667	1317	137.62	3.42	1034.51
EL84B	556	668	1316	135.72	2.42	1036.92
EL84B	557	669	1315	149.93	3.42	1040.34
EL84B	558	670	1314	147.25	1.92	1042.26
EL84B	559	671	1313	160.37	2.75	1045.01
EL84B	560	672	1312	148.90	3.00	1048.01
EL84B	561	673	1311	157.58	3.75	1051.76
EL84B	562	674	1310	135.01	2.33	1054.09
EL84B	563	675	1309	134.86	2.83	1056.92
EL84B	564	676	1308	152.73	1.83	1058.76
EL84B	565	677	1307	149.47	1.42	1060.17
EL84B	566	678	1306	166.59	1.33	1061.51
EL84B	567	679	1305	148.81	1.75	1063.26
EL84B	568	680	1304	172.22	1.42	1064.67
EL84B	569	681	1303	175.94	1.17	1065.84
EL84B	570	682	1302	171.99	1.08	1066.92
EL84B	571	683	1301	165.82	1.58	1068.51
EL84B	572	684	1300	161.20	1.67	1070.17
EL84B	573	685	1299	174.33	1.42	1071.59
EL84B	574	686	1298	155.47	1.42	1073.01
EL84B	575	687	1297	163.82	1.67	1074.67
EL84B	576	688	1296	151.29	1.75	1076.42
EL84B	577	689	1295	148.46	2.75	1079.17
EL84B	578	690	1294	153.71	2.50	1081.67
EL84B	579	691	1293	140.87	2.25	1083.92
EL84B	580	692	1292	166.40	1.83	1085.76
EL84B	581	693	1291	161.56	1.83	1087.59
EL84B	582	694	1290	163.99	1.92	1089.51
EL84B	583	695	1289	138.82	2.33	1091.84

Appendix I: Varve thickness and gray-scale measurements for last 1500 years of the Elk Lake varved sediment record.

Core No.	Varve No.	Age yBP	Age AD	Gray- Scale (0 to 255)	Thickness (mm)	Cum. Thick. (mm)
EL84B	584	696	1288	148.25	1.33	1093.17
EL84B	585	697	1287	145.07	1.50	1094.67
EL84B	586	698	1286	163.52	1.83	1096.51
EL84B	587	699	1285	149.68	2.42	1098.92
EL84B	588	700	1284	159.06	2.08	1101.01
EL84B	589	701	1283	148.75	1.75	1102.76
EL84B	590	702	1282	147.78	1.67	1104.42
EL84B	591	703	1281	150.07	1.92	1106.34
EL84B	592	704	1280	157.41	1.83	1108.17
EL84B	593	705	1279	148.41	2.17	1110.34
EL84B	594	706	1278	163.75	1.42	1111.76
EL84B	595	707	1277	168.14	1.75	1113.51
EL84B	596	708	1276	166.61	1.91	1115.42
EL84B	597	709	1275	157.40	2.58	1118.00
EL84B	598	710	1274	141.26	1.17	1119.17
EL84B	599	711	1273	151.50	1.92	1121.09
EL84B	600	712	1272	157.94	1.83	1122.92
EL84B	601	713	1271	180.12	1.50	1124.42
EL84B	602	714	1270	177.74	2.58	1127.00
EL84B	603	715	1269	167.61	2.00	1129.00
EL84B	604	716	1268	147.40	2.08	1131.09
EL84B	605	717	1267	152.81	2.92	1134.00
EL84B	606	718	1266	155.96	1.67	1135.67
EL84B	607	719	1265	169.23	1.67	1137.34
EL84B	608	720	1264	150.63	1.58	1138.92
EL84B	609	721	1263	156.54	1.92	1140.84
EL84B	610	722	1262	141.11	1.87	1142.70
EL84B	611	723	1261	130.99	1.20	1143.90
EL84B	612	724	1260	160.70	1.20	1145.10
EL84B	613	725	1259	168.44	1.20	1146.30
EL84B	614	726	1258	134.09	2.13	1148.44
EL84B	615	727	1257	118.14	1.47	1149.90
EL84B	616	728	1256	114.79	1.33	1151.24
EL84B	617	729	1255	115.25	1.33	1152.57
EL84B	618	730	1254	164.50	1.33	1153.90
EL84B	619	731	1253	156.78	1.47	1155.37
EL84B	620	732	1252	124.23	0.93	1156.30
EL84B	621	733	1251	168.77	1.33	1157.64
EL84B	622	734	1250	170.90	1.33	1158.97
EL84B	623	735	1249	150.29	1.73	1160.70
EL84B	624	736	1248	156.48	2.00	1162.70
EL84B	625	737	1247	181.64	0.80	1163.50
EL84B	626	738	1246	186.12	1.60	1165.10
EL84B	627	739	1245	192.80	1.87	1166.97
EL84B	628	740	1244	164.96	1.73	1168.70
EL84B	629	741	1243	186.06	2.53	1171.24
EL84B	630	742	1242	181.53	2.27	1173.50
EL84B	631	743	1241	157.50	2.53	1176.04
EL84B	632	744	1240	137.54	2.13	1178.17
EL84B	633	745	1239	122.33	2.67	1180.84
EL84B	634	746	1238	131.26	2.67	1183.50
EL84B	635	747	1237	111.65	2.13	1185.64
EL84B	636	748	1236	164.77	2.13	1187.77

Appendix I: Varve thickness and gray-scale measurements for last 1500 years of the Elk Lake varved sediment record.

Core No.	Varve No.	Age yBP	Age AD	Gray- Scale (0 to 255)	Thickness (mm)	Cum. Thick. (mm)
EL84B	637	749	1235	172.41	1.60	1189.37
EL84B	638	750	1234	184.73	2.00	1191.37
EL84B	639	751	1233	159.86	1.73	1193.10
EL84B	640	752	1232	170.02	1.60	1194.70
EL84B	641	753	1231	160.93	0.67	1195.37
EL84B	642	754	1230	181.49	1.73	1197.10
EL84B	643	755	1229	163.12	1.47	1198.57
EL84B	644	756	1228	144.36	1.87	1200.44
EL84B	645	757	1227	137.90	1.73	1202.17
EL84B	646	758	1226	142.00	1.87	1204.04
EL84B	647	759	1225	131.55	2.67	1206.70
EL84B	648	760	1224	132.64	2.40	1209.10
EL84B	649	761	1223	101.80	2.13	1211.24
EL84B	650	762	1222	178.43	2.00	1213.24
EL84B	651	763	1221	184.42	2.80	1216.04
EL84B	652	764	1220	161.92	1.47	1217.50
EL84B	653	765	1219	184.41	1.20	1218.70
EL84B	654	766	1218	186.03	1.73	1220.44
EL84B	655	767	1217	182.16	1.87	1222.30
EL84B	656	768	1216	163.91	2.00	1224.30
EL84B	657	769	1215	146.58	1.60	1225.90
EL84B	658	770	1214	159.80	1.87	1227.77
EL84B	659	771	1213	171.33	2.27	1230.04
EL84B	660	772	1212	173.25	2.00	1232.04
EL84B	661	773	1211	142.76	1.60	1233.64
EL84B	662	774	1210	177.15	1.60	1235.24
EL84B	663	775	1209	163.09	1.87	1237.10
EL84B	664	776	1208	139.88	1.87	1238.97
EL84B	665	777	1207	161.34	2.00	1240.97
EL84B	666	778	1206	155.93	2.40	1243.37
EL84B	667	779	1205	161.74	1.73	1245.10
EL84B	668	780	1204	195.58	1.47	1246.57
EL84B	669	781	1203	183.44	1.60	1257.10
EL84B	670	782	1202	183.71	1.20	1258.17
EL84B	671	783	1201	189.08	1.87	1259.10
EL84B	672	784	1200	182.18	1.60	1260.30
EL84B	673	785	1199	170.12	1.07	1262.17
EL84B	674	786	1198	171.84	1.07	1263.77
EL83B-1	675	787	1197	170.64	2.05	1265.82
EL83B-1	676	788	1196	165.70	1.81	1267.63
EL83B-1	677	789	1195	173.51	1.89	1269.52
EL83B-1	678	790	1194	160.99	2.20	1271.72
EL83B-1	679	791	1193	171.02	1.42	1273.14
EL83B-1	680	792	1192	162.32	1.10	1274.24
EL83B-1	681	793	1191	161.51	1.57	1275.82
EL83B-1	682	794	1190	168.91	1.65	1277.47
EL83B-1	683	795	1189	174.24	1.73	1279.20
EL83B-1	684	796	1188	169.53	1.65	1280.86
EL83B-1	685	797	1187	170.11	2.05	1282.90
EL83B-1	686	798	1186	175.09	1.18	1284.08
EL83B-1	687	799	1185	169.86	1.50	1285.58
EL83B-1	688	800	1184	162.74	1.89	1287.47
EL83B-1	689	801	1183	159.23	2.44	1289.91

Appendix I: Varve thickness and gray-scale measurements for last 1500 years of the Elk Lake varved sediment record.

Core No.	Varve No.	Age yBP	Age AD	Gray-Scale (0 to 255)	Thickness (mm)	Cum. Thick. (mm)
EL83B-1	690	802	1182	162.77	1.81	1291.72
EL83B-1	691	803	1181	154.48	1.10	1292.83
EL83B-1	692	804	1180	156.65	1.26	1294.08
EL83B-1	693	805	1179	156.00	1.42	1295.50
EL83B-1	694	806	1178	163.26	1.34	1296.84
EL83B-1	695	807	1177	156.62	2.05	1298.89
EL83B-1	696	808	1176	197.79	1.86	1300.75
EL83B-1	697	809	1175	129.18	1.57	1302.32
EL83B-1	698	810	1174	128.28	1.61	1303.93
EL83B-1	699	811	1173	200.06	1.82	1305.75
EL83B-1	700	812	1172	239.77	1.99	1307.74
EL83B-1	701	813	1171	236.42	1.36	1309.10
EL83B-1	702	814	1170	237.57	1.40	1310.50
EL83B-1	703	815	1169	195.23	1.57	1312.07
EL83B-1	704	816	1168	218.57	1.65	1313.72
EL83B-1	705	817	1167	239.72	2.50	1316.22
EL83B-1	706	818	1166	237.24	1.91	1318.13
EL83B-1	707	819	1165	225.28	1.57	1319.69
EL83B-1	708	820	1164	238.77	1.74	1321.43
EL83B-1	709	821	1163	239.64	1.40	1322.83
EL83B-1	710	822	1162	239.92	1.57	1324.40
EL83B-1	711	823	1161	231.81	1.48	1325.88
EL83B-1	712	824	1160	236.08	1.99	1327.87
EL83B-1	713	825	1159	229.79	1.69	1329.57
EL83B-1	714	826	1158	190.64	1.31	1330.88
EL83B-1	715	827	1157	174.23	1.53	1332.41
EL83B-1	716	828	1156	182.73	1.10	1333.51
EL83B-1	717	829	1155	196.38	1.48	1334.99
EL83B-1	718	830	1154	155.83	1.44	1336.43
EL83B-1	719	831	1153	202.01	1.53	1337.96
EL83B-1	720	832	1152	233.93	1.65	1339.61
EL83B-1	721	833	1151	220.44	1.40	1341.01
EL83B-1	722	834	1150	221.29	1.86	1342.87
EL83B-1	723	835	1149	230.58	1.78	1344.65
EL83B-1	724	836	1148	207.49	1.82	1346.47
EL83B-1	725	837	1147	216.47	1.40	1347.87
EL83B-1	726	838	1146	181.09	1.10	1348.97
EL83B-1	727	839	1145	211.07	1.44	1350.41
EL83B-1	728	840	1144	169.86	3.94	1354.35
EL83B-1	729	841	1143	219.65	9.15	1363.51
EL83B-1	730	842	1142	176.51	1.50	1365.00
EL83B-1	731	843	1141	175.43	1.57	1366.58
EL83B-1	732	844	1140	177.28	1.50	1368.07
EL83B-1	733	845	1139	175.69	1.42	1369.49
EL83B-1	734	846	1138	165.23	1.97	1371.46
EL83B-1	735	847	1137	163.09	1.81	1373.27
EL83B-1	736	848	1136	165.85	1.50	1374.77
EL83B-1	737	849	1135	168.23	1.10	1375.87
EL83B-1	738	850	1134	172.65	1.57	1377.44
EL83B-1	739	851	1133	161.57	2.05	1379.49
EL83B-1	740	852	1132	171.51	1.97	1381.46
EL83B-1	741	853	1131	165.23	2.52	1383.98
EL83B-1	742	854	1130	185.56	1.42	1385.40

Appendix I: Varve thickness and gray-scale measurements for last 1500 years of the Elk Lake varved sediment record.

Core No.	Varve No.	Age yBP	Age AD	Gray- Scale (0 to 255)	Thickness (mm)	Cum. Thick. (mm)
EL83B-1	743	855	1129	181.19	1.26	1386.66
EL83B-1	744	856	1128	167.66	1.50	1388.15
EL83B-1	745	857	1127	167.79	1.10	1389.25
EL83B-1	746	858	1126	184.02	1.73	1390.99
EL83B-1	747	859	1125	174.63	1.42	1392.40
EL83B-1	748	860	1124	169.02	1.18	1393.59
EL83B-1	749	861	1123	182.69	1.18	1394.77
EL83B-1	750	862	1122	179.96	1.50	1396.26
EL83B-1	751	863	1121	174.42	1.34	1397.60
EL83B-1	752	864	1120	172.27	1.02	1398.62
EL83B-1	753	865	1119	171.96	1.10	1399.73
EL83B-1	754	866	1118	159.46	1.02	1400.75
EL83B-1	755	867	1117	151.02	1.18	1401.93
EL83B-1	756	868	1116	132.18	1.97	1403.90
EL83B-1	757	869	1115	137.68	1.42	1405.32
EL83B-1	758	870	1114	146.84	1.65	1406.97
EL83B-1	759	871	1113	162.43	2.83	1409.81
EL83B-1	760	872	1112	138.73	33.62	1443.43
EL83B-1	761	873	1111	150.00	1.81	1445.24
EL83B-1	762	874	1110	133.69	1.34	1446.58
EL83B-1	763	875	1109	137.38	1.42	1447.99
EL83B-1	764	876	1108	166.20	1.50	1449.49
EL83B-1	765	877	1107	176.28	1.18	1450.67
EL83B-1	766	878	1106	174.77	1.10	1451.77
EL83B-1	767	879	1105	185.47	1.26	1453.03
EL83B-1	768	880	1104	183.08	1.42	1454.45
EL83B-1	769	881	1103	171.33	2.05	1456.50
EL83B-1	770	882	1102	183.26	1.65	1458.15
EL83B-1	771	883	1101	185.62	1.02	1459.18
EL83B-1	772	884	1100	182.42	1.10	1460.28
EL83B-1	773	885	1099	189.10	0.94	1461.22
EL83B-1	774	886	1098	191.68	0.39	1461.62
EL83B-1	775	887	1097	191.26	1.50	1463.11
EL83B-1	776	888	1096	187.70	1.26	1464.37
EL83B-1	777	889	1095	187.86	1.73	1466.11
EL83B-1	778	890	1094	195.69	1.57	1467.68
EL83B-1	779	891	1093	189.96	1.10	1468.78
EL83B-1	780	892	1092	190.30	1.42	1470.20
EL83B-1	781	893	1091	190.37	1.34	1471.54
EL83B-1	782	894	1090	196.92	1.81	1473.35
EL83B-1	783	895	1089	179.72	1.26	1474.61
EL83B-1	784	896	1088	154.79	1.81	1476.42
EL83B-1	785	897	1087	164.60	1.81	1478.23
EL83B-1	786	898	1086	165.84	1.50	1479.73
EL83B-1	787	899	1085	179.00	1.42	1481.14
EL83B-1	788	900	1084	175.35	1.50	1482.64
EL83B-1	789	901	1083	166.04	1.18	1483.82
EL83B-1	790	902	1082	158.85	1.65	1485.48
EL83B-1	791	903	1081	165.37	1.50	1486.97
EL83B-1	792	904	1080	156.64	1.18	1488.15
EL83B-1	793	905	1079	140.27	1.65	1489.81
EL83B-1	794	906	1078	138.59	1.42	1491.22
EL83B-1	795	907	1077	133.60	2.91	1494.14

Appendix I: Varve thickness and gray-scale measurements for last 1500 years of the Elk Lake varved sediment record.

Core No.	Varve No.	Age yBP	Age AD	Gray-Scale (0 to 255)	Thickness (mm)	Cum. Thick. (mm)
EL83B-1	796	908	1076	155.50	1.10	1495.24
EL83B-1	797	909	1075	147.08	1.50	1496.74
EL83B-1	798	910	1074	161.47	1.57	1498.31
EL83B-1	799	911	1073	162.77	1.02	1499.33
EL83B-1	800	912	1072	162.42	1.26	1500.59
EL83B-1	801	913	1071	150.50	1.97	1502.56
EL83B-1	802	914	1070	156.37	1.34	1503.90
EL83B-1	803	915	1069	135.72	1.65	1505.55
EL83B-1	804	916	1068	163.26	2.28	1507.84
EL83B-1	805	917	1067	165.02	1.81	1509.65
EL83B-1	806	918	1066	172.09	1.50	1511.14
EL83B-1	807	919	1065	169.79	1.57	1512.72
EL83B-1	808	920	1064	156.79	1.18	1513.90
EL83B-1	809	921	1063	163.06	1.18	1515.08
EL83B-1	810	922	1062	176.29	1.34	1516.42
EL83B-1	811	923	1061	174.10	1.50	1517.92
EL83B-1	812	924	1060	163.63	1.57	1519.49
EL83B-1	813	925	1059	161.38	1.26	1520.75
EL83B-1	814	926	1058	181.61	1.81	1522.56
EL83B-1	815	927	1057	165.50	1.50	1524.06
EL83B-1	816	928	1056	156.93	1.02	1525.08
EL83B-1	817	929	1055	163.65	1.50	1526.58
EL83B-1	818	930	1054	145.49	1.97	1528.55
EL83B-1	819	931	1053	153.73	1.50	1530.04
EL83B-1	820	932	1052	170.50	1.18	1531.22
EL83B-1	821	933	1051	157.53	1.81	1533.03
EL83B-1	822	934	1050	155.71	2.52	1535.55
EL83B-1	823	935	1049	151.91	2.05	1537.60
EL83B-1	824	936	1048	150.79	1.50	1539.10
EL83B-1	825	937	1047	155.30	1.10	1540.20
EL83B-1	826	938	1046	165.20	1.26	1541.46
EL83B-1	827	939	1045	177.75	2.05	1543.51
EL83B-1	828	940	1044	177.50	1.81	1545.32
EL83B-1	829	941	1043	163.89	1.42	1546.74
EL83B-1	830	942	1042	172.41	1.18	1547.92
EL83B-1	831	943	1041	166.97	1.65	1549.57
EL83B-1	832	944	1040	159.25	1.10	1550.67
EL83B-1	833	945	1039	167.16	1.26	1551.93
EL83B-1	834	946	1038	177.58	1.10	1553.03
EL83B-1	835	947	1037	173.63	1.50	1554.53
EL83B-1	836	948	1036	170.41	0.94	1555.48
EL83B-1	837	949	1035	171.90	1.18	1556.66
EL83B-1	838	950	1034	170.10	0.87	1557.52
EL83B-1	839	951	1033	165.76	1.26	1558.78
EL83B-1	840	952	1032	182.38	1.73	1560.51
EL83B-1	841	953	1031	162.84	1.97	1562.48
EL83B-1	842	954	1030	175.92	1.34	1563.82
EL83B-1	843	955	1029	179.17	1.26	1565.08
EL83B-1	844	956	1028	171.31	1.18	1566.26
EL83B-1	845	957	1027	171.96	1.10	1567.37
EL83B-1	846	958	1026	173.50	1.57	1568.94
EL83B-1	847	959	1025	168.13	1.73	1570.67
EL83B-1	848	960	1024	159.64	1.10	1571.77

Appendix I: Varve thickness and gray-scale measurements for last 1500 years of the Elk Lake varved sediment record.

Core No.	Varve No.	Age yBP	Age AD	Gray-Scale (0 to 255)	Thickness (mm)	Cum. Thick. (mm)
EL83B-1	849	961	1023	163.72	0.94	1572.72
EL83B-1	850	962	1022	183.08	1.65	1574.37
EL83B-1	851	963	1021	168.81	2.28	1576.66
EL83B-1	852	964	1020	171.19	1.34	1577.99
EL83B-1	853	965	1019	168.42	1.02	1579.02
EL83B-1	854	966	1018	166.95	1.89	1580.91
EL83B-1	855	967	1017	167.23	1.34	1582.25
EL83B-1	856	968	1016	161.50	1.57	1583.82
EL83B-1	857	969	1015	176.10	2.20	1586.03
EL83B-1	858	970	1014	181.46	1.26	1587.29
EL83B-1	859	971	1013	178.58	1.34	1588.62
EL83B-1	860	972	1012	167.96	1.42	1590.04
EL83B-1	861	973	1011	174.79	1.34	1591.38
EL83B-1	862	974	1010	168.76	1.42	1592.80
EL83B-1	863	975	1009	160.26	1.18	1593.98
EL83B-1	864	976	1008	160.46	1.34	1595.32
EL83B-1	865	977	1007	159.00	1.02	1596.34
EL83B-1	866	978	1006	154.88	1.34	1597.68
EL83B-1	867	979	1005	138.94	1.73	1599.41
EL83B-1	868	980	1004	146.71	1.57	1600.99
EL83B-1	869	981	1003	148.65	1.65	1602.64
EL83B-1	870	982	1002	147.70	1.73	1604.37
EL83B-1	871	983	1001	136.94	1.97	1606.34
EL83B-1	872	984	1000	129.28	1.73	1608.07
EL83B-1	873	985	999	143.14	1.50	1609.57
EL83B-1	874	986	998	107.41	1.50	1611.07
EL83B-1	875	987	997	127.02	3.39	1614.45
EL83B-1	876	988	996	155.18	2.44	1616.89
EL83B-1	877	989	995	163.52	1.73	1618.62
EL83B-1	878	990	994	157.48	1.65	1620.28
EL83B-1	879	991	993	163.25	1.42	1621.70
EL83B-1	880	992	992	166.36	1.18	1622.88
EL83B-1	881	993	991	156.84	1.42	1624.29
EL83B-1	882	994	990	147.49	1.42	1625.71
EL83B-1	883	995	989	127.70	1.26	1626.97
EL83B-1	884	996	988	109.10	1.50	1628.47
EL83B-1	885	997	987	114.32	1.26	1629.73
EL83B-1	886	998	986	126.12	1.18	1630.91
EL83B-1	887	999	985	167.80	1.57	1632.48
EL83B-1	888	1000	984	169.94	1.42	1633.90
EL83B-1	889	1001	983	161.51	1.10	1635.00
EL83B-1	890	1002	982	167.50	1.26	1636.26
EL83B-1	891	1003	981	180.20	1.34	1637.60
EL83B-1	892	1004	980	165.05	1.50	1639.10
EL83B-1	893	1005	979	168.33	1.57	1640.67
EL83B-1	894	1006	978	169.51	2.28	1642.96
EL83B-1	895	1007	977	162.37	1.73	1644.69
EL83B-1	896	1008	976	183.31	1.26	1645.95
EL83B-1	897	1009	975	186.59	1.34	1647.29
EL83B-1	898	1010	974	177.36	1.42	1648.70
EL83B-1	899	1011	973	178.97	1.26	1649.96
EL83B-1	900	1012	972	180.44	1.10	1651.07
EL83B-1	901	1013	971	182.95	1.34	1652.40

Appendix I: Varve thickness and gray-scale measurements for last 1500 years of the Elk Lake varved sediment record.

Core No.	Varve No.	Age yBP	Age AD	Gray- Scale (0 to 255)	Thickness (mm)	Cum. Thick. (mm)
EL83B-1	902	1014	970	171.47	1.10	1653.51
EL83B-1	903	1015	969	152.57	1.18	1654.69
EL83B-1	904	1016	968	165.64	1.57	1656.26
EL83B-1	905	1017	967	173.79	1.42	1657.68
EL83B-1	906	1018	966	147.99	1.57	1659.25
EL83B-1	907	1019	965	158.46	1.02	1660.28
EL83B-1	908	1020	964	159.48	1.89	1662.17
EL83B-1	909	1021	963	159.26	2.05	1664.22
EL83B-1	910	1022	962	164.00	1.81	1666.03
EL83B-1	911	1023	961	155.59	2.20	1668.23
EL83B-1	912	1024	960	164.32	2.52	1670.75
EL83B-1	913	1025	959	165.32	1.10	1671.85
EL83B-1	914	1026	958	174.29	1.50	1673.35
EL83B-1	915	1027	957	165.14	1.42	1674.77
EL83B-1	916	1028	956	157.00	1.02	1675.79
EL83B-1	917	1029	955	159.05	1.50	1677.29
EL83B-1	918	1030	954	160.21	1.42	1678.70
EL83B-1	919	1031	953	145.73	1.34	1680.04
EL83B-1	920	1032	952	147.14	1.18	1681.22
EL83B-1	921	1033	951	151.99	1.42	1682.64
EL83B-1	922	1034	950	140.67	1.50	1684.14
EL83B-1	923	1035	949	158.69	1.50	1685.63
EL83B-1	924	1036	948	162.76	1.18	1686.81
EL83B-1	925	1037	947	140.31	2.05	1688.86
EL83B-1	926	1038	946	157.92	1.10	1689.96
EL83B-1	927	1039	945	165.89	1.10	1691.07
EL83B-1	928	1040	944	170.70	1.34	1692.40
EL83B-1	929	1041	943	165.94	1.18	1693.59
EL83B-1	930	1042	942	158.18	1.97	1695.55
EL83B-1	931	1043	941	162.19	1.02	1696.58
EL83B-1	932	1044	940	165.82	1.42	1697.99
EL83B-1	933	1045	939	165.29	1.18	1699.18
EL83B-1	934	1046	938	156.49	1.02	1700.20
EL83B-1	935	1047	937	153.56	1.18	1701.38
EL83B-1	936	1048	936	133.12	1.89	1703.27
EL83B-1	937	1049	935	142.22	1.42	1704.69
EL83B-1	938	1050	934	155.67	2.20	1706.89
EL83B-1	939	1051	933	170.38	1.65	1708.55
EL83B-1	940	1052	932	146.90	1.89	1710.44
EL83B-1	941	1053	931	165.01	1.65	1712.09
EL83B-1	942	1054	930	156.54	1.65	1713.74
EL83B-1	943	1055	929	153.74	1.42	1715.16
EL83B-1	944	1056	928	171.69	1.81	1716.97
EL83B-1	945	1057	927	145.63	2.52	1719.49
EL83B-1	946	1058	926	155.70	2.83	1722.33
EL83B-1	947	1059	925	168.10	1.50	1723.82
EL83B-1	948	1060	924	155.23	1.50	1725.32
EL83B-1	949	1061	923	143.04	1.34	1726.66
EL83B-1	950	1062	922	151.70	1.26	1727.92
EL83B-1	951	1063	921	161.97	1.18	1729.10
EL83B-1	952	1064	920	154.52	1.42	1730.51
EL83B-1	953	1065	919	167.80	1.73	1732.25
EL83B-1	954	1066	918	161.88	1.73	1733.98

Appendix I: Varve thickness and gray-scale measurements for last 1500 years of the Elk Lake varved sediment record.

Core No.	Varve No.	Age yBP	Age AD	Gray-Scale (0 to 255)	Thickness (mm)	Cum. Thick. (mm)
EL83B-1	955	1067	917	169.11	1.34	1735.32
EL83B-1	956	1068	916	171.83	1.26	1736.58
EL83B-1	957	1069	915	152.68	1.81	1738.39
EL83B-1	958	1070	914	145.70	1.42	1739.81
EL83B-1	959	1071	913	146.27	2.20	1742.01
EL83B-1	960	1072	912	153.14	1.57	1743.59
EL83B-1	961	1073	911	147.27	1.73	1745.32
EL83B-1	962	1074	910	149.48	1.34	1746.66
EL83B-1	963	1075	909	134.55	1.50	1748.15
EL83B-1	964	1076	908	153.17	1.42	1749.57
EL83B-1	965	1077	907	154.79	1.42	1750.99
EL83B-1	966	1078	906	145.89	1.57	1752.56
EL83B-1	967	1079	905	151.94	1.73	1754.29
EL83B-1	968	1080	904	163.83	1.65	1755.95
EL83B-1	969	1081	903	147.81	1.65	1757.60
EL83B-1	970	1082	902	156.14	1.73	1759.33
EL83B-1	971	1083	901	163.33	1.02	1760.36
EL83B-1	972	1084	900	169.34	1.02	1761.38
EL83B-1	973	1085	899	169.64	1.65	1763.03
EL83B-1	974	1086	898	177.73	1.50	1764.53
EL83B-1	975	1087	897	168.72	1.34	1765.87
EL83B-1	976	1088	896	173.85	1.65	1767.52
EL83B-1	977	1089	895	146.24	2.13	1769.65
EL83B-1	978	1090	894	147.18	2.83	1772.48
EL83B-1	979	1091	893	155.83	2.13	1774.61
EL83B-1	980	1092	892	150.26	1.65	1776.26
EL83B-1	981	1093	891	132.54	1.89	1778.15
EL83B-1	982	1094	890	142.95	1.57	1779.73
EL83B-1	983	1095	889	150.57	1.89	1781.62
EL83B-1	984	1096	888	152.60	1.57	1783.19
EL83B-1	985	1097	887	147.25	1.89	1785.08
EL83B-1	986	1098	886	157.48	1.57	1786.66
EL83B-1	987	1099	885	157.87	1.57	1788.23
EL83B-1	988	1100	884	168.75	1.81	1790.04
EL83B-1	989	1101	883	162.21	1.34	1791.38
EL83B-1	990	1102	882	154.71	1.73	1793.11
EL83B-1	991	1103	881	168.01	1.89	1795.00
EL83B-1	992	1104	880	161.24	2.13	1797.13
EL83B-1	993	1105	879	157.82	1.65	1798.78
EL83B-1	994	1106	878	172.88	1.73	1800.51
EL83B-1	995	1107	877	168.88	1.65	1802.17
EL83B-1	996	1108	876	168.03	1.50	1803.66
EL83B-1	997	1109	875	177.26	1.57	1805.24
EL83B-1	998	1110	874	177.56	1.26	1806.50
EL83B-1	999	1111	873	177.85	1.73	1808.23
EL83B-1	1000	1112	872	169.88	1.50	1809.73
EL83B-1	1001	1113	871	176.33	1.50	1811.22
EL83B-1	1002	1114	870	155.92	1.50	1812.72
EL83B-1	1003	1115	869	148.18	1.34	1814.06
EL83B-1	1004	1116	868	156.48	1.26	1815.32
EL83B-1	1005	1117	867	159.37	1.97	1817.29
EL83B-1	1006	1118	866	147.27	1.57	1818.86
EL83B-1	1007	1119	865	135.14	2.13	1820.99

Appendix I: Varve thickness and gray-scale measurements for last 1500 years of the Elk Lake varved sediment record.

Core No.	Varve No.	Age yBP	Age AD	Gray- Scale (0 to 255)	Thickness (mm)	Cum. Thick. (mm)
EL83B-1	1008	1120	864	140.55	1.65	1822.64
EL83B-1	1009	1121	863	135.46	1.81	1824.45
EL83B-1	1010	1122	862	150.60	2.44	1826.89
EL83B-1	1011	1123	861	156.26	1.81	1828.70
EL83B-1	1012	1124	860	158.78	2.05	1830.75
EL83B-1	1013	1125	859	166.30	1.73	1832.48
EL83B-1	1014	1126	858	152.83	1.34	1833.82
EL83B-1	1015	1127	857	135.54	1.73	1835.55
EL83B-1	1016	1128	856	153.13	1.50	1837.05
EL83B-1	1017	1129	855	138.74	1.89	1838.94
EL83B-1	1018	1130	854	134.91	1.42	1840.36
EL83B-1	1019	1131	853	151.67	1.34	1841.70
EL83B-1	1020	1132	852	143.28	1.50	1843.19
EL83B-1	1021	1133	851	151.89	1.97	1845.16
EL83B-1	1022	1134	850	155.03	1.57	1846.74
EL83B-1	1023	1135	849	141.00	1.89	1848.62
EL83B-1	1024	1136	848	163.38	2.83	1851.46
EL83B-1	1025	1137	847	159.78	1.89	1853.35
EL83B-1	1026	1138	846	158.33	1.97	1855.32
EL83B-1	1027	1139	845	162.35	1.10	1856.42
EL83B-1	1028	1140	844	166.82	1.65	1858.07
EL83B-1	1029	1141	843	164.12	1.73	1859.81
EL83B-1	1030	1142	842	124.59	2.76	1862.56
EL83B-1	1031	1143	841	152.79	2.60	1865.16
EL83B-1	1032	1144	840	173.66	1.73	1866.89
EL83B-1	1033	1145	839	168.66	1.73	1868.62
EL83B-1	1034	1146	838	179.48	2.60	1871.22
EL83B-1	1035	1147	837	174.26	1.57	1872.80
EL83B-1	1036	1148	836	169.17	1.97	1874.77
EL83B-1	1037	1149	835	166.08	2.13	1876.89
EL83B-1	1038	1150	834	156.23	1.34	1878.23
EL83B-1	1039	1151	833	154.24	1.50	1879.73
EL83B-1	1040	1152	832	153.82	2.76	1882.48
EL83B-1	1041	1153	831	146.14	1.50	1883.98
EL83B-1	1042	1154	830	168.71	1.34	1885.32
EL83B-1	1043	1155	829	167.18	1.97	1887.29
EL83B-1	1044	1156	828	166.22	1.57	1888.86
EL83B-1	1045	1157	827	163.67	1.26	1890.12
EL83B-1	1046	1158	826	156.59	1.50	1891.62
EL83B-1	1047	1159	825	154.47	1.42	1893.03
EL83B-1	1048	1160	824	154.32	0.94	1893.98
EL83B-1	1049	1161	823	165.94	1.02	1895.00
EL83B-1	1050	1162	822	152.19	1.18	1896.18
EL83B-1	1051	1163	821	137.38	4.49	1900.67
EL83B-1	1052	1164	820	120.43	2.76	1903.43
EL83B-1	1053	1165	819	146.21	1.57	1905.00
EL83B-1	1054	1166	818	164.68	1.34	1906.34
EL83B-1	1055	1167	817	166.72	1.50	1907.84
EL83B-1	1056	1168	816	172.69	1.42	1909.25
EL83B-1	1057	1169	815	179.26	1.18	1910.44
EL83B-1	1058	1170	814	176.82	0.87	1911.30
EL83B-1	1059	1171	813	168.21	0.79	1912.09
EL83B-1	1060	1172	812	161.08	0.87	1912.96

Appendix I: Varve thickness and gray-scale measurements for last 1500 years of the Elk Lake varved sediment record.

Core No.	Varve No.	Age yBP	Age AD	Gray- Scale (0 to 255)	Thickness (mm)	Cum. Thick. (mm)
EL83B-1	1061	1173	811	170.51	0.87	1913.82
EL83B-1	1062	1174	810	168.83	1.42	1915.24
EL83B-1	1063	1175	809	162.10	0.94	1916.18
EL83B-1	1064	1176	808	165.14	1.50	1917.68
EL83B-1	1065	1177	807	162.24	1.50	1919.18
EL83B-1	1066	1178	806	159.24	1.97	1921.14
EL83B-1	1067	1179	805	155.42	1.34	1922.48
EL83B-1	1068	1180	804	147.01	0.94	1923.43
EL83B-1	1069	1181	803	156.72	1.02	1924.45
EL83B-1	1070	1182	802	157.22	1.42	1925.87
EL83B-1	1071	1183	801	152.90	1.34	1927.21
EL83B-1	1072	1184	800	156.37	1.10	1928.31
EL83B-1	1073	1185	799	156.55	1.42	1929.73
EL83B-1	1074	1186	798	155.61	1.02	1930.75
EL83B-1	1075	1187	797	156.57	1.26	1932.01
EL83B-1	1076	1188	796	154.32	1.50	1933.51
EL83B-1	1077	1189	795	145.10	1.34	1934.85
EL83B-1	1078	1190	794	145.71	1.34	1936.18
EL83B-1	1079	1191	793	146.94	1.50	1937.68
EL83B-1	1080	1192	792	151.64	1.18	1938.86
EL83B-1	1081	1193	791	149.76	1.50	1940.36
EL83B-1	1082	1194	790	140.24	1.34	1941.70
EL83B-1	1083	1195	789	151.08	1.18	1942.88
EL83B-1	1084	1196	788	165.48	1.10	1943.98
EL83B-1	1085	1197	787	156.00	1.42	1945.40
EL83B-1	1086	1198	786	136.14	1.50	1946.89
EL83B-1	1087	1199	785	152.23	1.26	1948.15
EL83B-1	1088	1200	784	152.81	1.26	1949.41
EL83B-1	1089	1201	783	160.29	1.73	1951.14
EL83B-1	1090	1202	782	157.09	1.97	1953.11
EL83B-1	1091	1203	781	151.45	1.18	1954.29
EL83B-1	1092	1204	780	155.91	1.57	1955.87
EL83B-1	1093	1205	779	142.92	1.97	1957.84
EL83B-1	1094	1206	778	141.11	1.57	1959.41
EL83B-1	1095	1207	777	152.05	1.42	1960.83
EL83B-1	1096	1208	776	162.61	1.42	1962.25
EL83B-1	1097	1209	775	146.80	1.34	1963.59
EL83B-1	1098	1210	774	161.08	1.89	1965.48
EL83B-1	1099	1211	773	135.41	2.52	1967.99
EL83B-1	1100	1212	772	165.35	2.20	1970.20
EL83B-1	1101	1213	771	169.40	2.28	1972.48
EL83B-1	1102	1214	770	166.66	1.57	1974.06
EL83B-1	1103	1215	769	150.93	1.57	1975.63
EL83B-1	1104	1216	768	159.11	1.42	1977.05
EL83B-1	1105	1217	767	162.00	1.18	1978.23
EL83B-1	1106	1218	766	162.58	1.42	1979.65
EL83B-1	1107	1219	765	161.31	1.18	1980.83
EL83B-1	1108	1220	764	150.09	1.42	1982.25
EL83B-1	1109	1221	763	156.50	1.73	1983.98
EL83B-1	1110	1222	762	154.88	1.26	1985.24
EL83B-1	1111	1223	761	158.54	1.02	1986.26
EL83B-1	1112	1224	760	163.67	1.73	1987.99
EL83B-1	1113	1225	759	169.48	1.65	1989.65

Appendix I: Varve thickness and gray-scale measurements for last 1500 years of the Elk Lake varved sediment record.

Core No.	Varve No.	Age yBP	Age AD	Gray- Scale (0 to 255)	Thickness (mm)	Cum. Thick. (mm)
EL83B-1	1114	1226	758	169.67	1.97	1991.62
EL83B-1	1115	1227	757	159.07	1.89	1993.51
EL83B-1	1116	1228	756	153.81	2.05	1995.55
EL83B-1	1117	1229	755	152.57	2.13	1997.68
EL83B-1	1118	1230	754	153.80	1.34	1999.02
EL83B-1	1119	1231	753	161.40	1.65	2000.67
EL83B-1	1120	1232	752	158.82	1.26	2001.93
EL83B-1	1121	1233	751	157.40	0.87	2002.80
EL83B-1	1122	1234	750	168.45	0.94	2003.74
EL83B-1	1123	1235	749	160.38	0.71	2004.45
EL83B-1	1124	1236	748	152.57	0.87	2005.32
EL83B-1	1125	1237	747	159.66	1.10	2006.42
EL83B-1	1126	1238	746	146.39	1.50	2007.92
EL83B-1	1127	1239	745	143.88	1.42	2009.33
EL83B-1	1128	1240	744	161.29	1.73	2011.07
EL83B-1	1129	1241	743	148.21	1.34	2012.40
EL83B-1	1130	1242	742	143.95	2.20	2014.61
EL83B-1	1131	1243	741	157.45	2.36	2016.97
EL83B-1	1132	1244	740	158.26	1.34	2018.31
EL83B-1	1133	1245	739	168.98	1.34	2019.65
EL83B-1	1134	1246	738	153.00	1.65	2021.30
EL83B-1	1135	1247	737	161.08	1.89	2023.19
EL83B-1	1136	1248	736	166.21	1.50	2024.69
EL83B-1	1137	1249	735	158.91	1.65	2026.34
EL83B-1	1138	1250	734	170.68	1.57	2027.92
EL83B-1	1139	1251	733	174.90	1.18	2029.10
EL83B-1	1140	1252	732	170.25	1.18	2030.28
EL83B-1	1141	1253	731	147.01	1.18	2031.46
EL83B-1	1142	1254	730	150.60	0.87	2032.33
EL83B-1	1143	1255	729	165.44	1.26	2033.59
EL83B-1	1144	1256	728	163.44	1.42	2035.00
EL83B-1	1145	1257	727	138.63	1.34	2036.34
EL83B-1	1146	1258	726	147.18	1.34	2037.68
EL83B-1	1147	1259	725	135.88	1.65	2039.33
EL83B-1	1148	1260	724	121.50	1.42	2040.75
EL83B-1	1149	1261	723	134.23	1.42	2042.17
EL83B-1	1150	1262	722	131.11	1.73	2043.90
EL83B-1	1151	1263	721	153.11	1.42	2045.32
EL83B-1	1152	1264	720	148.21	0.94	2046.26
EL83B-1	1153	1265	719	160.78	0.94	2047.21
EL83B-1	1154	1266	718	173.69	1.97	2049.18
EL83B-1	1155	1267	717	173.67	1.97	2051.14
EL83B-1	1156	1268	716	165.77	1.89	2053.03
EL83B-1	1157	1269	715	160.74	1.57	2054.61
EL83B-1	1158	1270	714	155.34	1.57	2056.18
EL83B-1	1159	1271	713	167.06	1.97	2058.15
EL83B-1	1160	1272	712	169.68	1.34	2059.49
EL83B-1	1161	1273	711	153.10	1.50	2060.99
EL83B-1	1162	1274	710	163.92	1.34	2062.33
EL83B-1	1163	1275	709	157.84	1.26	2063.59
EL83B-1	1164	1276	708	149.10	1.26	2064.85
EL83B-1	1165	1277	707	165.49	1.34	2066.18
EL83B-1	1166	1278	706	158.87	0.94	2067.13

Appendix I: Varve thickness and gray-scale measurements for last 1500 years of the Elk Lake varved sediment record.

Core No.	Varve No.	Age yBP	Age AD	Gray-Scale (0 to 255)	Thickness (mm)	Cum. Thick. (mm)
EL83B-1	1167	1279	705	155.22	1.10	2068.23
EL83B-1	1168	1280	704	149.69	1.57	2069.81
EL83B-1	1169	1281	703	146.28	2.13	2071.93
EL83B-1	1170	1282	702	156.88	1.34	2073.27
EL83B-1	1171	1283	701	161.20	1.26	2074.53
EL83B-1	1172	1284	700	151.76	1.65	2076.18
EL83B-1	1173	1285	699	160.85	1.26	2077.44
EL83B-1	1174	1286	698	139.34	1.97	2079.41
EL83B-1	1175	1287	697	149.45	1.26	2080.67
EL83B-1	1176	1288	696	152.87	1.26	2081.93
EL83B-1	1177	1289	695	157.13	1.18	2083.11
EL83B-1	1178	1290	694	173.24	2.13	2085.24
EL83B-1	1179	1291	693	174.82	1.26	2086.50
EL83B-1	1180	1292	692	176.31	1.42	2087.92
EL83B-1	1181	1293	691	169.16	1.34	2089.25
EL83B-1	1182	1294	690	175.55	2.05	2091.30
EL83B-1	1183	1295	689	161.25	2.44	2093.74
EL83B-1	1184	1296	688	164.23	1.50	2095.24
EL83B-1	1185	1297	687	160.13	1.42	2096.66
EL83B-1	1186	1298	686	155.74	1.10	2097.76
EL83B-1	1187	1299	685	160.81	1.34	2099.10
EL83B-1	1188	1300	684	151.48	1.57	2100.67
EL83B-1	1189	1301	683	144.49	1.42	2102.09
EL83B-1	1190	1302	682	125.08	1.42	2103.51
EL83B-1	1191	1303	681	160.15	2.44	2105.95
EL83B-1	1192	1304	680	162.83	1.10	2107.05
EL83B-1	1193	1305	679	159.58	1.26	2108.31
EL83B-1	1194	1306	678	150.63	1.81	2110.12
EL83B-1	1195	1307	677	151.04	1.65	2111.77
EL83B-1	1196	1308	676	152.89	1.57	2113.35
EL83B-1	1197	1309	675	156.12	1.73	2115.08
EL83B-1	1198	1310	674	158.47	1.34	2116.42
EL83B-1	1199	1311	673	168.63	1.34	2117.76
EL83B-1	1200	1312	672	157.80	1.18	2118.94
EL83B-1	1201	1313	671	164.28	1.18	2120.12
EL83B-1	1202	1314	670	163.90	1.10	2121.22
EL83B-1	1203	1315	669	159.92	1.57	2122.80
EL83B-1	1204	1316	668	150.87	1.10	2123.90
EL83B-1	1205	1317	667	149.13	1.42	2125.32
EL83B-1	1206	1318	666	150.81	1.42	2126.74
EL83B-1	1207	1319	665	168.44	1.89	2128.62
EL83B-1	1208	1320	664	166.02	1.34	2129.96
EL83B-1	1209	1321	663	155.30	1.65	2131.62
EL83B-1	1210	1322	662	143.41	0.47	2132.09
EL83B-1	1211	1323	661	139.22	1.26	2133.35
EL83B-1	1212	1324	660	151.41	1.57	2134.92
EL83B-1	1213	1325	659	160.22	1.02	2135.95
EL83B-1	1214	1326	658	163.90	1.02	2136.97
EL83B-1	1215	1327	657	149.84	1.26	2138.23
EL83B-1	1216	1328	656	153.48	1.65	2139.88
EL83B-1	1217	1329	655	159.60	1.26	2141.14
EL83B-1	1218	1330	654	161.63	1.34	2142.48
EL83B-1	1219	1331	653	160.08	1.73	2144.22

Appendix I: Varve thickness and gray-scale measurements for last 1500 years of the Elk Lake varved sediment record.

Core No.	Varve No.	Age yBP	Age AD	Gray- Scale (0 to 255)	Thickness (mm)	Cum. Thick. (mm)
EL83B-1	1220	1332	652	166.65	1.42	2145.63
EL83B-1	1221	1333	651	169.49	1.18	2146.81
EL83B-1	1222	1334	650	168.97	1.34	2148.15
EL83B-1	1223	1335	649	173.43	1.50	2149.65
EL83B-1	1224	1336	648	177.64	1.26	2150.91
EL83B-1	1225	1337	647	171.08	1.50	2152.40
EL83B-1	1226	1338	646	163.91	1.18	2153.59
EL83B-1	1227	1339	645	166.74	1.18	2154.77
EL83B-1	1228	1340	644	164.90	1.02	2155.79
EL83B-1	1229	1341	643	169.92	1.18	2156.97
EL83B-1	1230	1342	642	160.15	1.73	2158.70
EL83B-1	1231	1343	641	154.88	0.87	2159.57
EL83B-1	1232	1344	640	164.21	1.10	2160.67
EL83B-1	1233	1345	639	161.12	1.34	2162.01
EL83B-1	1234	1346	638	163.10	1.81	2163.82
EL83B-1	1235	1347	637	161.81	0.87	2164.69
EL83B-1	1236	1348	636	164.14	1.26	2165.95
EL83B-1	1237	1349	635	163.34	2.13	2168.07
EL83B-1	1238	1350	634	172.40	1.50	2169.57
EL83B-1	1239	1351	633	160.11	1.10	2170.67
EL83B-1	1240	1352	632	155.54	1.26	2171.93
EL83B-1	1241	1353	631	158.47	1.02	2172.96
EL83B-1	1242	1354	630	158.50	1.18	2174.14
EL83B-1	1243	1355	629	158.54	0.94	2175.08
EL83B-1	1244	1356	628	168.61	1.34	2176.42
EL83B-1	1245	1357	627	161.20	1.26	2177.68
EL83B-1	1246	1358	626	163.93	0.94	2178.62
EL83B-1	1247	1359	625	164.05	0.47	2179.10
EL83B-1	1248	1360	624	160.07	0.71	2179.81
EL83B-1	1249	1361	623	153.65	1.02	2180.83
EL83B-1	1250	1362	622	150.97	1.02	2181.85
EL83B-1	1251	1363	621	133.51	1.18	2183.03
EL83B-1	1252	1364	620	115.42	0.79	2183.82
EL83B-1	1253	1365	619	122.66	0.94	2184.77
EL83B-1	1254	1366	618	126.67	0.71	2185.48
EL83B-1	1255	1367	617	136.38	1.18	2186.66
EL83B-1	1256	1368	616	146.37	1.34	2187.99
EL83B-1	1257	1369	615	134.37	1.18	2189.18
EL83B-1	1258	1370	614	132.01	1.26	2190.44
EL83B-1	1259	1371	613	134.33	0.94	2191.38
EL83B-1	1260	1372	612	136.64	1.26	2192.64
EL83B-1	1261	1373	611	138.69	1.26	2193.90
EL83B-1	1262	1374	610	148.14	1.50	2195.40
EL83B-1	1263	1375	609	131.84	1.02	2196.42
EL83B-1	1264	1376	608	138.72	1.26	2197.68
EL83B-1	1265	1377	607	155.71	1.50	2199.18
EL83B-1	1266	1378	606	157.57	1.65	2200.83
EL83B-1	1267	1379	605	171.83	1.81	2202.64
EL83B-1	1268	1380	604	170.82	1.81	2204.45
EL83B-1	1269	1381	603	168.75	1.97	2206.42
EL83B-1	1270	1382	602	165.62	1.02	2207.44
EL83B-1	1271	1383	601	152.04	1.02	2208.47
EL83B-1	1272	1384	600	157.30	1.10	2209.57

Appendix I: Varve thickness and gray-scale measurements for last 1500 years of the Elk Lake varved sediment record.

Core No.	Varve No.	Age yBP	Age AD	Gray-Scale (0 to 255)	Thickness (mm)	Cum. Thick. (mm)
EL83B-1	1273	1385	599	157.33	1.42	2210.99
EL83B-1	1274	1386	598	157.90	1.02	2212.01
EL83B-1	1275	1387	597	141.58	1.26	2213.27
EL83B-1	1276	1388	596	134.71	1.34	2214.61
EL83B-1	1277	1389	595	150.44	1.18	2215.79
EL83B-1	1278	1390	594	160.18	1.18	2216.97
EL83B-1	1279	1391	593	164.56	1.18	2218.15
EL83B-1	1280	1392	592	157.30	0.87	2219.02
EL83B-1	1281	1393	591	134.49	1.10	2220.12
EL83B-1	1282	1394	590	121.63	1.26	2221.38
EL83B-1	1283	1395	589	118.62	0.94	2222.33
EL83B-1	1284	1396	588	131.67	0.94	2223.27
EL83B-1	1285	1397	587	128.09	1.42	2224.69
EL83B-1	1286	1398	586	123.05	1.02	2225.71
EL83B-1	1287	1399	585	130.79	0.94	2226.66
EL83B-1	1288	1400	584	143.36	0.94	2227.60
EL83B-1	1289	1401	583	147.35	0.79	2228.39
EL83B-1	1290	1402	582	150.39	1.10	2229.49
EL83B-1	1291	1403	581	152.54	0.63	2230.12
EL83B-1	1292	1404	580	155.73	0.79	2230.91
EL83B-1	1293	1405	579	149.31	0.94	2231.85
EL83B-1	1294	1406	578	155.92	0.94	2232.80
EL83B-1	1295	1407	577	161.38	1.42	2234.22
EL83B-1	1296	1408	576	158.62	1.02	2235.24
EL83B-1	1297	1409	575	167.62	1.26	2236.50
EL83B-1	1298	1410	574	167.89	1.34	2237.84
EL83B-1	1299	1411	573	165.12	3.15	2240.99
EL83B-1	1300	1412	572	160.22	1.73	2242.72
EL83B-1	1301	1413	571	156.52	1.42	2244.14
EL83B-1	1302	1414	570	163.15	1.89	2246.03
EL83B-1	1303	1415	569	148.91	2.05	2248.07
EL83B-1	1304	1416	568	165.21	1.81	2249.88
EL83B-1	1305	1417	567	164.07	1.42	2251.30
EL83B-1	1306	1418	566	165.02	1.02	2252.33
EL83B-1	1307	1419	565	164.09	0.71	2253.03
EL83B-1	1308	1420	564	159.31	1.42	2254.45
EL83B-1	1309	1421	563	141.47	1.18	2255.63
EL83B-1	1310	1422	562	134.70	2.05	2257.68
EL83B-1	1311	1423	561	134.75	1.10	2258.78
EL83B-1	1312	1424	560	138.68	0.94	2259.73
EL83B-1	1313	1425	559	147.79	0.87	2260.59
EL83B-1	1314	1426	558	154.29	0.87	2261.46
EL83B-1	1315	1427	557	161.74	0.79	2262.25
EL83B-1	1316	1428	556	130.42	1.50	2263.74
EL83B-1	1317	1429	555	134.61	0.71	2264.45
EL83B-1	1318	1430	554	146.44	1.34	2265.79
EL83B-1	1319	1431	553	155.58	1.42	2267.21
EL83B-1	1320	1432	552	163.32	1.34	2268.55
EL83B-1	1321	1433	551	156.73	1.73	2270.28
EL83B-1	1322	1434	550	152.13	0.94	2271.22
EL83B-1	1323	1435	549	154.16	1.02	2272.25
EL83B-1	1324	1436	548	159.88	1.89	2274.14
EL83B-1	1325	1437	547	147.16	1.02	2275.16

Appendix I: Varve thickness and gray-scale measurements for last 1500 years of the Elk Lake varved sediment record.

Core No.	Varve No.	Age yBP	Age AD	Gray- Scale (0 to 255)	Thickness (mm)	Cum. Thick. (mm)
EL83B-1	1326	1438	546	147.31	1.02	2276.18
EL83B-1	1327	1439	545	157.19	1.18	2277.37
EL83B-1	1328	1440	544	142.58	1.42	2278.78
EL83B-1	1329	1441	543	139.84	1.57	2280.36
EL83B-1	1330	1442	542	129.64	2.28	2282.64
EL83B-1	1331	1443	541	144.45	2.36	2285.00
EL83B-1	1332	1444	540	146.05	1.73	2286.74
EL83B-1	1333	1445	539	154.69	1.57	2288.31
EL83B-1	1334	1446	538	156.06	1.50	2289.81
EL83B-1	1335	1447	537	156.76	1.02	2290.83
EL83B-1	1336	1448	536	152.99	1.26	2292.09
EL83B-1	1337	1449	535	150.46	1.65	2293.74
EL83B-1	1338	1450	534	144.99	1.18	2294.92
EL83B-1	1339	1451	533	148.81	1.18	2296.11
EL83B-1	1340	1452	532	138.89	1.34	2297.44
EL83B-1	1341	1453	531	148.09	1.34	2298.78
EL83B-1	1342	1454	530	144.81	1.50	2300.28
EL83B-1	1343	1455	529	153.76	1.81	2302.09
EL83B-1	1344	1456	528	148.53	1.65	2303.74
EL83B-1	1345	1457	527	156.93	0.94	2304.69
EL83B-1	1346	1458	526	163.42	1.34	2306.03
EL83B-1	1347	1459	525	139.55	1.34	2307.37
EL83B-1	1348	1460	524	145.49	1.57	2308.94
EL83B-1	1349	1461	523	139.07	1.65	2310.59
EL83B-1	1350	1462	522	151.48	2.05	2312.64
EL83B-1	1351	1463	521	143.67	1.34	2313.98
EL83B-1	1352	1464	520	131.99	2.13	2316.11
EL83B-1	1353	1465	519	150.69	1.65	2317.76
EL83B-1	1354	1466	518	139.58	1.50	2319.25
EL83B-1	1355	1467	517	153.57	1.26	2320.51
EL83B-1	1356	1468	516	156.02	1.89	2322.40
EL83B-1	1357	1469	515	160.92	1.65	2324.06
EL83B-1	1358	1470	514	143.48	1.57	2325.63
EL83B-1	1359	1471	513	147.60	0.94	2326.58
EL83B-1	1360	1472	512	163.52	1.65	2328.23
EL83B-1	1361	1473	511	171.23	1.42	2329.65
EL83B-1	1362	1474	510	141.39	1.97	2331.62
EL83B-1	1363	1475	509	151.59	1.50	2333.11
EL83B-1	1364	1476	508	150.55	1.42	2334.53
EL83B-1	1365	1477	507	168.98	1.10	2335.63
EL83B-1	1366	1478	506	176.34	1.34	2336.97
EL83B-1	1367	1479	505	166.52	1.26	2338.23
EL83B-1	1368	1480	504	147.74	1.10	2339.33
EL83B-1	1369	1481	503	142.62	0.94	2340.28
EL83B-1	1370	1482	502	145.20	1.57	2341.85
EL83B-1	1371	1483	501	153.89	1.81	2343.66
EL83B-1	1372	1484	500	165.26	1.42	2345.08
EL83B-1	1373	1485	499	150.76	1.65	2346.74
EL83B-1	1374	1486	498	151.69	1.50	2348.23
EL83B-1	1375	1487	497	159.74	1.02	2349.25
EL83B-1	1376	1488	496	154.91	1.34	2350.59
EL83B-1	1377	1489	495	118.05	1.42	2352.01
EL83B-1	1378	1490	494	98.94	1.50	2353.51

Appendix I: Varve thickness and gray-scale measurements for last 1500 years of the Elk Lake varved sediment record.

Core No.	Varve No.	Age yBP	Age AD	Gray-Scale (0 to 255)	Thickness (mm)	Cum. Thick. (mm)
EL83B-1	1379	1491	493	87.25	1.50	2355.00
EL83B-1	1380	1492	492	83.19	1.89	2356.89
EL83B-1	1381	1493	491	75.54	1.65	2358.55
EL83B-1	1382	1494	490	92.64	1.65	2360.20
EL83B-1	1383	1495	489	94.14	1.57	2361.77
EL83B-1	1384	1496	488	80.02	2.28	2364.06
EL83B-1	1385	1497	487	99.74	4.02	2368.07
EL83B-1	1386	1498	486	94.18	2.83	2370.91
EL83B-1	1387	1499	485	103.45	2.20	2373.11
EL83B-1	1388	1500	484	85.72	2.20	2375.32
EL83B-1	1389	1501	483	86.77	3.23	2378.55
EL83B-1	1390	1502	482	106.04	1.97	2380.51
EL83B-1	1391	1503	481	107.95	1.34	2381.85
EL83B-1	1392	1504	480	133.99	2.13	2383.98
EL83B-1	1393	1505	479	171.71	2.05	2386.03
EL83B-1	1394	1506	478	160.62	1.81	2387.84
EL83B-1	1395	1507	477	168.62	1.26	2389.10
EL83B-1	1396	1508	476	172.68	1.10	2390.20
EL83B-1	1397	1509	475	180.98	1.65	2391.85
EL83B-1	1398	1510	474	180.19	1.65	2393.51
EL83B-1	1399	1511	473	186.04	1.42	2394.92
EL83B-1	1400	1512	472	181.42	1.50	2396.42
EL83B-1	1401	1513	471	186.08	1.50	2397.92
EL83B-1	1402	1514	470	169.80	1.65	2399.57
EL83B-1	1403	1515	469	167.47	1.18	2400.75
EL83B-1	1404	1516	468	173.22	1.18	2401.93
EL83B-1	1405	1517	467	172.11	1.26	2403.19
EL83B-1	1406	1518	466	176.88	1.73	2404.92
EL83B-1	1407	1519	465	153.29	1.42	2406.34
EL83B-1	1408	1520	464	104.38	1.81	2408.15
EL83B-1	1409	1521	463	113.74	1.73	2409.88
EL83B-1	1410	1522	462	113.45	1.81	2411.70
EL83B-1	1411	1523	461	120.91	1.65	2413.35
EL83B-1	1412	1524	460	128.21	2.36	2415.71
EL83B-1	1413	1525	459	135.32	1.65	2417.37
EL83B-1	1414	1526	458	138.28	1.89	2419.25
EL83B-1	1415	1527	457	137.30	1.57	2420.83

Appendix II. Percentages of CaCO3, total carbon, inorganic carbon, and organic carbon.

Varve Yr BP	Varve Yr AD	% CaCO3	% Total C	% Inorganic C	% Organic C
2	1982	13.98	11.05	1.68	9.38
5	1979	13.13	12.04	1.58	10.47
8	1976	17.16	10.86	2.06	8.80
11	1973	16.54	11.24	1.99	9.25
13	1971	16.34	11.84	1.96	9.88
17	1967	15.92	11.67	1.91	9.76
20	1964	14.69	11.37	1.76	9.61
23	1961	14.83	11.56	1.78	9.78
26	1958	12.58	10.21	1.51	8.70
30	1954	14.56	10.98	1.75	9.23
33	1951	16.62	11.92	1.99	9.92
36	1948	16.63	11.52	2.00	9.52
39	1945	16.46	11.33	1.98	9.36
42	1942	15.83	11.15	1.90	9.25
45	1939	15.44	10.83	1.85	8.98
48	1936	16.10	10.42	1.93	8.49
51	1933	18.63	11.61	2.24	9.38
54	1930	18.60	11.62	2.23	9.39
56	1928	18.92	12.17	2.27	9.90
59	1925	16.73	11.24	2.01	9.24
62	1922	15.89	8.24	1.91	6.33
65	1919	16.86	8.16	2.02	6.13
68	1916	12.88	9.81	1.55	8.27
71	1913	12.58	9.33	1.51	7.82
74	1910	19.15	10.64	2.30	8.34
76	1908	18.58	9.95	2.23	7.72
79	1905	16.18	10.77	1.94	8.83
82	1902	17.69	10.09	2.12	7.96
85	1899	20.86	11.12	2.50	8.62
88	1896	18.43	10.03	2.21	7.82
91	1893	26.77	11.01	3.21	7.80
93	1891	24.47	10.58	2.94	7.65
96	1888	29.13	11.83	3.50	8.33
98	1886	29.46	11.25	3.54	7.71
101	1883	21.54	9.54	2.59	6.96
103	1881	26.61	12.07	3.19	8.88
106	1878	24.56	12.26	2.95	9.32
108	1876	19.52	10.47	2.34	8.13
111	1873	21.92	10.63	2.63	8.00
113	1871	21.76	10.21	2.61	7.60
116	1868	42.37	11.53	5.08	6.44
120	1864	43.05	12.14	5.17	6.97
128	1856	34.56	11.66	4.15	7.51
134	1850	44.60	12.09	5.35	6.74
140	1844	48.95	12.23	5.87	6.36
145	1839	40.89	12.17	4.91	7.26
148	1836	39.78	12.00	4.77	7.22
152	1832	31.53	11.67	3.78	7.88
157	1827	41.68	12.23	5.00	7.23
162	1822	45.33	12.50	5.44	7.07
167	1817	39.62	12.05	4.75	7.30
173	1811	37.94	12.66	4.55	8.11
178	1806	35.25	11.71	4.23	7.48
182	1802	38.93	12.19	4.67	7.52

Appendix II. Percentages of CaCO3, total carbon, inorganic carbon, and organic carbon.

Varve Yr BP	Varve Yr AD	% CaCO3	% Total C	% Inorganic C	% Organic C
187	1797	35.68	11.50	4.28	7.22
192	1792	41.21	11.41	4.95	6.46
198	1786	34.16	11.11	4.10	7.01
202	1782	36.30	11.92	4.36	7.56
206	1778	32.46	11.20	3.90	7.31
211	1773	41.34	12.54	4.96	7.58
217	1767	52.20	13.12	6.26	6.86
222	1762	48.09	12.61	5.77	6.84
227	1757	47.30	12.11	5.68	6.43
233	1751	49.38	12.63	5.93	6.71
238	1746	46.68	11.56	5.60	5.96
242	1742	50.56	12.36	6.07	6.30
246	1738	46.43	11.13	5.57	5.56
250	1734	44.79	12.17	5.37	6.79
255	1729	38.79	10.89	4.65	6.23
259	1725	42.07	11.19	5.05	6.14
262	1722	44.32	11.30	5.32	5.98
266	1718	49.61	12.35	5.95	6.40
270	1714	48.47	12.00	5.82	6.18
274	1710	48.89	12.89	5.87	7.02
279	1705	36.51	12.29	4.38	7.90
284	1700	22.96	11.76	2.75	9.01
290	1694	24.45	10.55	2.93	7.62
295	1689	36.58	11.98	4.39	7.59
299	1685	40.59	12.47	4.87	7.60
304	1680	42.75	12.61	5.13	7.48
309	1675	38.39	11.72	4.61	7.12
313	1671	40.43	11.96	4.85	7.10
318	1666	51.53	13.01	6.18	6.82
323	1661	51.23	13.37	6.15	7.22
328	1656	51.12	12.65	6.13	6.51
334	1650	47.21	13.09	5.67	7.42
340	1644	41.55	12.31	4.99	7.33
347	1637	38.92	13.07	4.67	8.40
355	1629	43.34	13.28	5.20	8.08
362	1622	58.68	14.94	7.04	7.90
367	1617	49.91	11.94	5.99	5.95
372	1612	43.35	12.61	5.20	7.40
378	1606	45.05	13.20	5.41	7.79
383	1601	45.78	12.40	5.49	6.90
389	1595	48.06	12.69	5.77	6.92
395	1589	47.08	13.25	5.65	7.60
401	1583	54.50	12.48	6.54	5.94
407	1577	61.97	13.95	7.44	6.51
413	1571	42.26	11.91	5.07	6.83
417	1567	45.29	11.89	5.44	6.46
423	1561	40.90	11.43	4.91	6.53
427	1557	46.56	11.61	5.59	6.02
432	1552	46.76	11.73	5.61	6.12
439	1545	47.92	12.39	5.75	6.64
446	1538	42.06	11.08	5.05	6.03
452	1532	47.49	12.21	5.70	6.51
458	1526	51.34	11.48	6.16	5.32
462	1522	49.05	12.22	5.89	6.34
468	1516	50.86	12.48	6.10	6.37

Appendix II. Percentages of CaCO3, total carbon, inorganic carbon, and organic carbon.

Varve Yr BP	Varve Yr AD	% CaCO3	% Total C	% Inorganic C	% Organic C
474	1510	41.39	11.64	4.97	6.67
480	1504	40.95	10.87	4.91	5.95
485	1499	44.95	12.56	5.39	7.16
491	1493	35.95	10.89	4.31	6.58
496	1488	33.06	10.91	3.97	6.94
501	1483	35.55	10.61	4.27	6.34
507	1477	40.06	12.40	4.81	7.59
514	1470	36.59	10.94	4.39	6.54
520	1464	38.39	12.32	4.61	7.71
527	1457	43.95	12.32	5.27	7.05
532	1452	55.58	13.61	6.67	6.94
537	1447	52.50	12.61	6.30	6.31
541	1443	46.67	12.53	5.60	6.93
547	1437	45.95	12.58	5.51	7.07
554	1430	36.50	11.06	4.38	6.68
561	1423	47.13	11.81	5.66	6.15
568	1416	48.23	12.52	5.79	6.73
573	1411	26.58	12.00	3.19	8.81
579	1405	43.92	12.17	5.27	6.90
585	1399	26.50	10.58	3.18	7.40
591	1393	24.48	9.71	2.94	6.77
596	1388	25.00	10.54	3.00	7.54
603	1381	23.08	10.69	2.77	7.92
611	1373	20.87	10.00	2.50	7.50
617	1367	35.17	10.93	4.22	6.71
623	1361	23.82	10.38	2.86	7.52
629	1355	26.17	11.94	3.14	8.80
634	1350	39.42	10.96	4.73	6.23
640	1344	30.17	10.28	3.62	6.66
645	1339	28.17	9.29	3.38	5.91
652	1332	33.08	9.88	3.97	5.91
658	1326	39.86	12.33	4.78	7.55
662	1322	36.20	10.84	4.34	6.50
667	1317	41.58	11.15	4.99	6.16
670	1314	63.46	11.92	7.62	4.31
674	1310	49.40	11.59	5.93	5.67
679	1305	54.33	12.66	6.52	6.14
685	1299	47.42	12.03	5.69	6.34
690	1294	52.50	12.54	6.30	6.24
695	1289	46.25	12.96	5.55	7.41
700	1284	45.33	13.76	5.44	8.32
706	1278	41.17	11.14	4.94	6.20
712	1272	39.67	11.59	4.76	6.83
717	1267	47.00	11.66	5.64	6.02
721	1263	44.50	11.60	5.34	6.26
727	1257	44.39	11.38	5.33	6.05
735	1249	37.92	11.76	4.55	7.21
741	1243	47.25	11.06	5.67	5.39
746	1238	54.67	12.63	6.56	6.07
750	1234	34.17	10.07	4.10	5.97
756	1228	45.74	11.89	5.49	6.40
762	1222	49.75	11.63	5.97	5.66
767	1217	44.82	11.21	5.38	5.83
772	1212	43.92	11.88	5.27	6.61
773	1212	39.12	11.72	4.69	7.03

Appendix II. Percentages of CaCO3, total carbon, inorganic carbon, and organic carbon.

Varve Yr BP	Varve Yr AD	% CaCO3	% Total C	% Inorganic C	% Organic C
780	1205	40.87	11.51	4.90	6.61
785	1200	37.08	12.27	4.45	7.82
789	1196	30.65	10.49	3.68	6.81
795	1190	40.74	12.38	4.89	7.49
801	1184	34.57	10.93	4.15	6.78
807	1178	44.99	12.50	5.40	7.10
811	1174	44.59	11.41	5.35	6.06
817	1168	31.29	10.43	3.75	6.68
823	1162	30.33	10.14	3.64	6.50
829	1156	35.94	10.27	4.31	5.96
835	1150	35.86	9.32	4.30	5.02
841	1144	32.11	9.76	3.85	5.90
843	1142	7.64	2.06	0.92	1.14
847	1138	15.36	5.37	1.84	3.53
853	1132	43.21	10.95	5.19	5.76
859	1126	39.99	11.39	4.80	6.59
867	1118	22.75	10.64	2.73	7.91
872	1113	30.69	12.12	3.68	8.44
877	1108	33.90	10.53	4.07	6.46
883	1102	35.00	11.35	4.20	7.15
892	1093	32.95	10.81	3.95	6.86
899	1086	28.93	10.23	3.47	6.76
905	1080	37.94	10.79	4.55	6.24
912	1073	41.80	10.72	5.02	5.70
919	1066	39.85	11.22	4.78	6.44
925	1060	37.81	11.12	4.54	6.58
932	1053	44.17	11.45	5.30	6.15
936	1049	41.29	11.66	4.95	6.71
942	1043	17.70	9.30	2.12	7.18
950	1035	33.32	11.98	4.00	7.98
957	1028	25.76	10.20	3.09	7.11
964	1021	36.35	11.86	4.36	7.50
971	1014	43.22	11.48	5.19	6.29
978	1007	32.21	11.27	3.87	7.41
985	1000	41.72	11.43	5.01	6.43
990	995	52.00	12.94	6.24	6.70
996	989	28.92	11.37	3.47	7.90
1003	982	41.42	13.59	4.97	8.62
1010	975	29.75	11.92	3.57	8.35
1017	968	12.12	9.60	1.45	8.15
1023	962	35.25	10.73	4.23	6.50
1028	957	36.83	11.30	4.42	6.88
1036	949	45.25	11.94	5.43	6.51
1044	941	41.50	11.50	4.98	6.52
1051	934	42.02	10.96	5.04	5.92
1057	928	42.00	11.48	5.04	6.44
1062	923	33.33	10.34	4.00	6.34
1069	916	50.83	12.88	6.10	6.78
1075	910	44.33	12.25	5.32	6.93
1082	903	44.85	12.17	5.38	6.78
1089	896	34.01	10.91	4.08	6.83
1096	891	33.18	11.56	3.98	7.58
1099	886	45.45	12.40	5.45	6.95
1105	880	42.98	12.80	5.16	7.64
1110	875	32.74	12.40	3.93	8.48

Appendix II. Percentages of $CaCO_3$, total carbon, inorganic carbon, and organic carbon.

Varve Yr BP	Varve Yr AD	% $CaCO_3$	% Total C	% Inorganic C	% Organic C
1117	868	24.00	12.67	2.88	9.79
1123	862	41.83	11.14	5.02	6.12
1128	857	51.00	12.04	6.12	5.92
1134	851	43.25	11.18	5.19	5.99
1139	846	43.11	11.34	5.17	6.16
1144	841	40.67	11.47	4.88	6.59
1149	836	41.42	11.54	4.97	6.57
1154	831	36.67	11.71	4.40	7.31
1160	825	47.00	13.66	5.64	8.02
1166	819	32.65	11.57	3.92	7.66
1173	812	41.44	11.56	4.97	6.59
1180	805	35.61	12.00	4.27	7.73
1190	795	43.91	12.65	5.27	7.38
1196	789	46.82	12.16	5.62	6.54
1203	782	47.82	13.15	5.74	7.41
1209	776	50.92	11.99	6.11	5.88
1214	771	47.33	12.20	5.68	6.52
1221	764	50.50	11.64	6.06	5.58
1227	758	49.83	12.64	5.98	6.66
1233	752	46.93	11.75	5.63	6.12
1241	744	59.67	12.63	7.16	5.47
1247	738	47.75	11.42	5.73	5.69
1254	731	48.08	12.65	5.77	6.88
1262	723	51.08	12.03	6.13	5.90
1269	716	52.43	12.34	6.29	6.05
1274	711	28.72	10.98	3.45	7.53
1281	704	33.75	11.54	4.05	7.49
1289	696	26.16	10.38	3.14	7.24
1296	689	34.36	10.75	4.12	6.63
1302	683	20.70	9.72	2.48	7.24
1308	677	30.17	10.48	3.62	6.86
1315	670	26.92	9.91	3.23	6.68
1323	662	27.92	11.54	3.35	8.19
1330	655	26.75	10.54	3.21	7.33
1338	647	23.95	11.49	2.87	8.61
1344	641	19.54	11.64	2.34	9.30
1354	631	17.90	10.74	2.15	8.59
1363	622	21.16	11.68	2.54	9.14
1373	612	22.58	11.75	2.71	9.04
1380	605	43.42	12.26	5.21	7.05
1387	598	39.71	12.70	4.77	7.93
1395	590	21.04	10.98	2.52	8.45
1405	580	37.13	12.39	4.46	7.93
1414	571	34.22	11.80	4.11	7.69
1418	567	25.55	12.12	3.07	9.05
1426	559	30.33	10.20	3.64	6.56
1435	550	31.08	11.40	3.73	7.67
1443	542	33.83	11.11	4.06	7.05
1448	537	35.25	12.00	4.23	7.77
1456	529	31.89	10.29	3.83	6.47
1462	523	34.75	11.27	4.17	7.10
1468	517	35.83	10.52	4.30	6.22
1475	510	47.50	12.22	5.70	6.52
1483	502	44.17	10.99	5.30	5.69
1490	495	35.99	10.05	4.32	5.73

Appendix II. Percentages of CaCO3, total carbon, inorganic carbon, and organic carbon.

Varve Yr BP	Varve Yr AD	% CaCO3	% Total C	% Inorganic C	% Organic C
1496	489	48.58	10.20	5.83	4.37
1500	485	37.25	10.38	4.47	5.91
1504	481	43.83	10.94	5.26	5.68
1509	476	38.70	9.54	4.64	4.90
1516	469	37.24	10.66	4.47	6.19
1523	462	46.58	11.64	5.59	6.05
1529	456	46.67	12.20	5.60	6.60
1535	450	42.50	12.45	5.10	7.35

Appendix III. X-ray diffraction mineralogy. Units are peak height in detector counts.

Varve Yr BP	Varve Yr AD	QUARTZ 26.6	FELDSPAR 27	FELDSPAR 28	CALCITE 29.5	DOLOMITE 30.8	RHODO. 31.5
2	1982	370			467	62	
5	1979	408			564	27	
8	1976	331			759	58	
11	1973	289		38	640	31	
13	1971	306		41	566		
17	1967	257		31	475	39	
20	1964	191		31	292	27	
23	1961	262		35	506		
26	1958	210		26	310		
30	1954	424		39	552		
33	1951	506		35	700		
36	1948	292		39	739		
39	1945	428		27	642		
42	1942	875		47	681		
45	1939	292		58	584		
48	1936	331		27	681		
51	1933	331		70	622		
54	1930	253			506		
56	1928	195		47	447		
59	1925	389		39	700		
62	1922	441			586	32	27
65	1919	449	102	92	630		
68	1916	292		32	449		
71	1913	219			467		
74	1910	350			700		
76	1908	161		29	529		
79	1905	180		64	497		
82	1902	202			625		
85	1899	190			586		
88	1896	253			622		
91	1893	214			1011		
93	1891	222		36	740		
96	1888	175			973		
98	1886	123			1056		28
101	1883	159			734	27	
103	1881	240			876		
106	1878	110			784		
108	1876	85			702		
111	1873	90			692		30
113	1871	136			875	31	27
116	1868	88			1544		27
120	1864	97			1536	27	31
128	1856	117			1050		31
134	1850	331			1556		31
140	1844	93			1828		31
145	1839	182			1354	27	40
148	1836	136			1478		35
152	1832	100			1116	40	29
157	1827	72			1482		53
162	1822	113			1984	27	43
167	1817	117			1478	51	39
173	1811	144			1498		27
178	1806	124			1225		27
182	1802	124			1342		27

Appendix III. X-ray diffraction mineralogy. Units are peak height in detector counts.

Varve Yr BP	Varve Yr AD	QUARTZ 26.6	FELDSPAR 27	FELDSPAR 28	CALCITE 29.5	DOLOMITE 30.8	RHODO. 31.5
187	1797	117			1264		31
192	1792	128			1225		27
198	1786	117			1148		35
202	1782	156			1342		39
206	1778	117			973		
211	1773	233			1673	51	43
217	1767	136			1906	43	67
222	1762	175			1828	47	58
227	1757	117	31		1653	47	70
233	1751	156			1772	49	40
238	1746	214			1614	39	47
242	1742	216			1806	49	38
246	1738	130			1369	52	38
250	1734	159			1552	85	36
255	1729	190			1318	25	29
259	1725	253		39	1828	35	31
262	1722	175		54	1498	31	39
266	1718	148		35	1789	27	54
270	1714	280			1867	51	47
274	1710	389			1731	51	43
279	1705	195			1148	47	
284	1700	370			739	54	27
290	1694	175		27	642	39	27
295	1689	156		27	1225		27
299	1685	175			1517	27	27
304	1680	206			1789	27	31
309	1675	144		52	1289	29	26
313	1671	159			1459	31	42
318	1666	169			1892	40	55
323	1661	161		34	1980	46	48
328	1656	136			1770	31	51
334	1650	117	31		1848		47
340	1644	136			1323	35	43
347	1637	175			1362		39
355	1629	136			1575		27
362	1622	67		31	1505		38
367	1617	93			1692		43
372	1612	102			1253		27
378	1606	124			1556	39	35
383	1601	214		39	1673	27	43
389	1595	156		35	1537	31	43
395	1589	237		25	1764	46	37
401	1583	135			2043	35	59
407	1577	104			2391		69
413	1571	86		34	1347		32
417	1567	175			1595	31	47
423	1561	180			1444		30
427	1557	98			1756		44
432	1552	219		26	1513	29	45
439	1545	243		26	1756	59	59
446	1538	156			1400	39	47
452	1532	79			1722	26	45
458	1526	110		25	1756		48
462	1522	136			1595	43	43

Appendix III. X-ray diffraction mineralogy. Units are peak height in detector counts.

Varve Yr BP	Varve Yr AD	QUARTZ 26.6	FELDSPAR 27	FELDSPAR 28	CALCITE 29.5	DOLOMITE 30.8	RHODOCHROSITE 31.5
468	1516	92			1429	46	36
474	1510	175			1867		51
480	1504	121			1482		27
485	1499	117			1653		39
491	1493	81			1149		29
496	1488	102			1190		26
501	1483	109			1167		35
507	1477	136			1498		27
514	1470	117			1264		27
520	1464	117			1282		27
527	1457	82			1459		39
532	1452	117			2217	31	51
537	1447	272			1848		62
541	1443	237			1706		42
547	1437	77			1706	41	48
554	1430	94			1176		
561	1423	113			1653		70
568	1416	155.6			1808		78
573	1411	249			914	62	58
579	1405	190			1482		50
585	1399	250			936		58
591	1393	265			934	58	[illegible]
596	1388	137		171	832		
603	1381	151			756		34
611	1373	225			729		30
617	1367	199			1267	24	36
623	1361	156			778		58
629	1355	117			759		
634	1350	128			1259		78
640	1344	151		27	1024	40	37
645	1339	174		27	882		26
652	1332	509			1245	39	58
658	1326	96			1296		37
662	1322	130			1109		40
667	1317	136			1299	58	
670	1314	164			1624	38	48
674	1310	292			1778	51	66
679	1305	257			1867	51	97
685	1299	149			1600	29	42
690	1294	175		97	1673		70
695	1289	204		46	1747	29	59
700	1284	311			2194	58	70
706	1278	193		25	2440	44	77
712	1272	231		26	2683	52	71
717	1267	109		54	1537		54
721	1263	169		92	2820	40	74
727	1257	97			1439		58
735	1249	106		27	2601	45	76
741	1243	282			3260	36	94
746	1238	216		81	3931	55	106
750	1234	161		20	2153	30	55
756	1228	105			1575		74
762	1222	185		22	1849	44	55
767	1217	156		39	1595	54	62

Appendix III. X-ray diffraction mineralogy. Units are peak height in detector counts.

Varve Yr BP	Varve Yr AD	QUARTZ 26.6	FELDSPAR 27	FELDSPAR 28	CALCITE 29.5	DOLOMITE 30.8	RHODOCHROSITE 31.5
772	1212	424		31	2788	46	71
773	1212	268		51	2683	71	72
780	1205	159		27	2540	59	71
785	1200	253		20	2218	42	69
789	1196	180			1892	60	61
795	1190	202			2735	76	52
801	1184	113		51	1206	62	62
807	1178	365		132	3238	100	88
811	1174	392		37	3047	74	88
817	1168	159		40	1892	50	55
823	1162	213		34	1815	44	50
829	1156	261		39	1225	78	70
835	1150	272		78	1284	62	51
841	1144	261		78	1124	97	58
843	1142	2171	105	311	136	241	74
847	1138	1770	70	210	428	175	
853	1132	136			1428	62	70
859	1126	188			2550	66	66
867	1118	37	77	81	1376	56	56
872	1113	204		26	1998	44	64
877	1108	306			1927	55	66
883	1102	97			735		74
892	1093	250		48	1936	42	69
899	1086	259		56	1815	30	58
905	1080	182			2343	30	83
912	1073	228		20	2725	46	83
919	1066	97			1400	54	74
925	1060	117		22	2218	98	112
932	1053	180		31	2663	46	69
936	1049	185		23	2652	53	74
942	1043	130		23	790	40	53
950	1035	105			984	51	54
957	1028	213			1568	31	59
964	1021	135			2172	64	64
971	1014	174			2735	38	94
978	1007	204		40	2079	94	74
985	1000	132			1284	58	78
990	995	276		56	3387	88	108
996	989	180		45	1616	59	76
1003	982	262		31	2411	38	106
1010	975	185		32	1954	83	77
1017	968	124		58	292	58	58
1023	962	164		49	2209	45	55
1028	957	182		42	2304	50	74
1036	949	149		17	2735	53	100
1044	941	144		20	2460	64	77
1051	934	97			1284	51	78
1057	928	313		83	2663	66	88
1062	923	174		37	1815	50	74
1069	916	219		74	3181	53	108
1075	910	276		44	2746	90	83
1082	903	136			1634	54	58
1089	896	477		66	1183	66	62
1096	891	156			934	58	58

Appendix III. X-ray diffraction mineralogy. Units are peak height in detector counts.

Varve Yr BP	Varve Yr AD	QUARTZ 26.6	FELDSPAR 27	FELDSPAR 28	CALCITE 29.5	DOLOMITE 30.8	RHODOCHROSITE 31.5
1099	886	175			1533	51	66
1105	880	159		233	1459	51	62
1110	875	117		39	934	78	58
1117	868	296		35	1513	30	48
1123	862	225		28	2632	104	90
1128	857	328		38	3612	67	106
1134	851	346		41	2756	67	86
1139	846	136		54	1206	51	58
1144	841	149		94	2632	94	74
1149	836	149			2714	42	83
1154	831	161			2190	90	62
1160	825	161			2190	90	62
1166	819	105			969		58
1173	812	97		57	1412	54	62
1180	805	156			1113	78	78
1190	795	121			1498	58	78
1196	789	136			1630	58	112
1203	782	117			1583	47	66
1209	776				3226		86
1214	771	135			3102		94
1221	764	225			3329	79	104
1227	758						
1233	752	148			1408	58	66
1241	744	124		51	1964	39	78
1247	738	183		58	1517	62	54
1254	731	144	39		1669	58	78
1262	723	82			1556	86	78
1269	716	182		78	1863	66	93
1274	711	113			875	66	54
1281	704	175			1011	58	58
1289	696	66		86	817	54	74
1296	689	152			1116		66
1302	683	93			545	51	62
1308	677	110			1505		
1315	670	172		36	1421		125
1323	662	149			1673	34	55
1330	655	125			1529	40	76
1338	647	128			751	58	62
1344	641	97			584	78	54
1354	631	117		39	572	58	54
1363	622	105			685	58	66
1373	612	148			607	58	47
1380	605	117		54	1556	58	78
1387	598	97		58	1338	58	74
1395	590	78	54	51	599		74
1405	580	93		78	1323	62	48
1414	571	78			1144	66	66
1418	567	78		62	720	78	58
1426	559	185			1421	52	72
1435	550	339			1858	41	49
1443	542	137			1945	48	71
1448	537	179			1858	41	112
1456	529	93		43	1015	70	78
1462	523	196			1918	55	83

Appendix III. X-ray diffraction mineralogy. Units are peak height in detector counts.

Varve Yr BP	Varve Yr AD	QUARTZ 26.6	FELDSPAR 27	FELDSPAR 28	CALCITE 29.5	DOLOMITE 30.8	RHODOCHROSITE 31.5
1468	517	166			1989	45	86
1475	510	320			2767	66	100
1483	502	269			2642	53	92
1490	495	117		51	1070	58	78
1496	489	199		190	2601	83	135
1500	485	600			2200	66	96
1504	481	408			2560		98
1509	476	324		74	2098	56	142
1516	469	121			1186	66	82
1523	462	256			3080	106	108
1529	456	243			2694	61	108
1535	450	193		58	2652		119

Appendix IV. Concentrations of major elements (in percent) and trace elements (in parts per million, ppm).

Varve Yr	Yr. AD	% Al	% Ca	% Fe	% K	% Mg	% Na	% P	% Ti	% Mn	ppm As	ppm Ba	ppm Ce	ppm Co	ppm Cr	ppm Cu	ppm Ga	ppm La	ppm Li
75	1908	0.91	9.2	11.0	0.30	0.46	0.22	0.84	0.04	0.90	93	400	10	6	13	11	17	6	6.0
80	1903	0.78	8.7	11.0	0.26	0.43	0.18	0.68	0.03	1.00	96	380	8	6	10	8	18	5	4.0
86	1897	0.92	10.0	10.0	0.30	0.48	0.21	0.75	0.04	0.83	84	400	10	6	11	16	14	6	5.0
92	1891	0.70	13.0	9.3	0.23	0.50	0.17	0.86	0.03	0.74	92	430	8	5	8	25	13	5	4.0
97	1886	0.55	14.0	10.0	0.20	0.50	0.18	0.85	0.02	0.79	100	410	5	5	7	5	13	4	3.0
102	1881	0.46	12.0	12.0	0.15	0.45	0.13	0.99	0.02	1.10	110	370	5	5	7	8	16	3	1.4
110	1873	0.36	11.0	14.0	0.14	0.40	0.14	1.00	0.02	0.99	130	370	5	5	5	8	16	3	2.0
118	1865	0.44	19.0	9.8	0.14	0.59	0.12	1.00	0.02	0.70	97	450	4	4	6	6	13	3	3.0
133	1850	0.41	18.0	10.0	0.14	0.59	0.11	1.10	0.02	1.00	93	450	<4	4	6	14	18	3	3.0
142	1841	0.40	20.0	9.2	0.13	0.60	0.11	0.77	0.02	1.20	77	450	4	4	5	6	21	3	3.0
150	1833	0.45	16.0	11.0	0.15	0.59	0.12	0.99	0.02	1.20	100	430	<4	5	7	5	20	3	3.0
159	1824	0.42	20.0	8.4	0.14	0.65	0.11	0.87	0.02	0.92	79	450	4	4	5	6	16	3	3.0
170	1813	0.48	20.0	7.7	0.16	0.69	0.14	0.76	0.02	0.96	80	400	<4	4	6	4	15	3	3.0
180	1803	0.53	18.0	8.4	0.18	0.67	0.14	1.00	0.02	0.72	82	400	5	5	7	7	13	4	3.0
189	1794	0.44	17.0	10.0	0.14	0.62	0.13	1.10	0.02	1.10	100	440	<4	5	5	5	18	3	3.0
200	1783	0.47	16.0	10.0	0.16	0.64	0.14	0.91	0.02	1.20	110	400	5	5	5	7	22	3	3.0
209	1774	0.56	17.0	10.0	0.19	0.65	0.15	0.89	0.02	1.90	99	460	6	5	7	7	30	3	3.0
220	1763	0.63	21.0	6.2	0.23	0.78	0.17	0.83	0.03	0.73	70	470	5	5	9	7	13	4	4.0
230	1753	0.56	22.0	7.3	0.21	0.78	0.16	0.83	0.03	1.20	80	510	5	5	8	8	22	4	4.0
244	1739	0.74	21.0	7.7	0.23	0.77	0.19	0.56	0.03	1.30	80	520	6	6	9	7	22	5	4.0
257	1726	0.72	18.0	10.0	0.24	0.70	0.20	0.65	0.03	1.60	100	500	7	6	9	7	28	5	5.0
264	1719	0.66	21.0	8.2	0.22	0.73	0.18	0.75	0.03	1.10	88	520	7	6	8	7	19	4	4.0
272	1711	0.89	21.0	7.2	0.29	0.82	0.24	0.61	0.04	1.10	73	570	8	6	11	14	20	5	5.0
282	1701	0.89	15.0	10.0	0.26	0.67	0.20	0.83	0.03	2.20	110	540	8	7	10	9	34	5	5.0
292	1691	0.94	13.0	12.0	0.27	0.60	0.20	1.00	0.04	2.20	120	510	9	7	12	9	36	6	6.0
302	1681	0.81	19.0	7.9	0.24	0.69	0.19	0.85	0.03	1.20	69	590	7	6	11	17	21	5	5.0
311	1672	0.87	18.0	8.5	0.25	0.67	0.20	0.68	0.04	1.50	75	540	8	6	10	4	26	5	5.0
321	1662	0.60	23.0	6.7	0.21	0.75	0.17	0.67	0.03	0.75	66	510	7	5	9	9	14	4	4.0
331	1652	0.57	22.0	7.1	0.18	0.72	0.15	0.88	0.02	0.88	74	560	5	4	7	8	16	4	3.0
343	1640	0.64	19.0	9.4	0.21	0.67	0.17	1.00	0.03	1.40	97	520	6	5	8	8	23	4	4.0
358	1625	0.49	23.0	6.3	0.18	0.65	0.14	0.70	0.02	1.20	65	500	5	4	7	6	21	4	3.0
370	1613	0.52	21.0	9.2	0.17	0.61	0.13	1.10	0.02	0.94	93	510	5	4	6	7	16	3	3.0
380	1603	0.62	20.0	9.6	0.19	0.63	0.15	0.96	0.03	1.20	95	530	5	5	8	2	21	4	4.0
392	1591	0.55	21.0	8.2	0.20	0.70	0.15	0.99	0.02	0.76	78	530	5	5	8	7	13	4	4.0
404	1579	0.52	25.0	5.7	0.18	0.70	0.13	0.68	0.02	0.57	59	530	4	5	7	6	9	3	4.0
415	1568	0.54	19.0	8.9	0.17	0.63	0.13	0.64	0.02	0.74	75	440	5	4	7	9	13	3	3.0
425	1558	0.58	20.0	9.2	0.19	0.62	0.15	0.65	0.02	0.92	70	480	5	5	7	7	15	4	4.0
435	1548	0.65	20.0	9.1	0.20	0.68	0.16	0.75	0.03	0.63	78	490	8	5	9	8	12	4	4.0
449	1534	0.54	20.0	8.8	0.18	0.61	0.13	0.76	0.02	0.70	80	460	5	4	7	1	11	3	3.0

Appendix IV. Concentrations of major elements (in percent) and trace elements (in parts per million, ppm).

Appendix IV. Concentrations of major elements (in percent) and trace elements (in parts per million, ppm).

Varve Yr	Yr. AD	% Al	% Ca	% Fe	% K	% Mg	% Na	% P	% Ti	% Mn	ppm As	ppm Ba	ppm Ce	ppm Co	ppm Cr	ppm Cu	ppm Ga	ppm La	ppm Li
460	1523	0.50	21.0	8.7	0.17	0.62	0.13	0.78	0.02	0.86	66	530	5	4	7	8	15	4	3.0
471	1512	0.55	20.0	8.2	0.17	0.65	0.13	0.70	0.02	0.73	63	460	5	5	8	10	12	5	4.0
482	1501	0.49	18.0	10.0	0.14	0.57	0.11	0.90	0.02	0.96	78	430	4	5	6	5	15	4	3.0
493	1490	0.39	16.0	12.0	0.12	0.50	0.09	0.97	0.02	0.83	94	390	<4	5	5	6	13	4	2.0
504	1479	0.42	16.0	12.0	0.12	0.49	0.10	0.94	0.02	1.00	86	420	5	5	6	12	17	4	3.0
517	1466	0.45	16.0	11.0	0.13	0.50	0.11	0.79	0.02	1.10	82	400	<4	5	6	7	16	4	3.0
529	1454	0.47	23.0	7.7	0.13	0.58	0.11	0.83	0.02	0.61	69	430	<4	5	6	6	9	4	3.0
539	1444	0.49	22.0	7.5	0.14	0.61	0.11	0.74	0.02	0.66	65	480	4	5	7	6	10	4	3.0
550	1433	0.42	19.0	8.8	0.12	0.53	0.09	0.81	0.01	0.67	71	400	<4	6	6	5	10	4	3.0
564	1419	0.50	20.0	9.2	0.15	0.53	0.10	1.00	0.02	1.10	71	510	4	5	6	8	17	5	3.0
575	1408	0.81	17.0	10.0	0.23	0.56	0.14	1.10	0.03	1.40	91	510	7	6	9	13	22	7	5.0
588	1395	1.00	12.0	13.0	0.28	0.54	0.17	1.20	0.04	1.80	98	470	10	7	11	7	25	7	6.0
599	1384	0.88	12.0	13.0	0.25	0.49	0.15	1.30	0.03	1.40	110	430	10	6	9	8	23	8	5.0
614	1369	0.84	12.0	12.0	0.24	0.49	0.16	1.10	0.03	1.10	100	370	9	6	9	9	18	7	5.0
626	1357	0.51	12.0	14.0	0.15	0.47	0.13	1.40	0.02	1.10	110	390	6	5	7	9	17	5	3.0
637	1346	0.93	16.0	11.0	0.25	0.66	0.19	0.96	0.04	1.50	90	470	9	6	13	7	24	7	5.0
648	1335	0.76	14.0	12.0	0.21	0.57	0.17	0.76	0.03	2.20	84	470	6	6	10	9	30	6	4.0
660	1323	0.59	16.0	9.6	0.17	0.58	0.13	0.83	0.02	1.60	76	440	6	6	8	7	23	4	4.0
668	1315	0.65	18.0	8.9	0.19	0.64	0.14	0.92	0.02	1.00	75	460	6	5	9	14	16	5	4.0
672	1311	1.00	21.0	5.7	0.27	0.80	0.19	0.69	0.04	0.74	46	520	10	5	15	8	13	7	6.0
687	1296	0.83	21.0	6.4	0.23	0.72	0.18	0.69	0.03	0.92	52	520	6	5	11	6	15	6	5.0
697	1286	0.94	20.0	6.4	0.26	0.71	0.19	0.89	0.03	0.86	61	550	7	6	13	8	14	7	5.0
709	1274	0.55	17.0	11.0	0.15	0.56	0.11	0.88	0.02	1.10	75	450	5	5	7	7	16	5	3.0
719	1264	0.46	20.0	8.5	0.13	0.61	0.11	0.76	0.02	0.88	63	460	<4	5	6	6	13	4	3.0
731	1252	0.36	17.0	11.0	0.11	0.51	0.09	1.10	0.01	0.60	83	420	<4	5	6	12	9	4	3.0
743	1240	0.46	22.0	6.8	0.13	0.63	0.10	0.80	0.02	0.40	61	420	<4	4	7	10	6	4	3.0
753	1230	0.54	17.0	12.0	0.15	0.52	0.11	1.10	0.02	0.88	87	440	4	5	7	6	13	5	3.0
764	1219	0.88	20.0	7.3	0.25	0.66	0.17	0.56	0.03	0.53	53	480	8	4	10	6	9	6	4.0
775	1208	0.74	19.0	8.5	0.21	0.64	0.15	0.92	0.03	0.59	66	480	6	5	10	10	10	6	4.0
787	1196	0.70	16.0	11.0	0.19	0.57	0.14	1.00	0.03	0.93	75	400	7	5	9	14	16	6	4.0
		0.50	16.0	12.0	0.14	0.54	0.11	1.10	0.02	0.96	75	390	4	5	7	2	13	4	2.0
		0.45	15.0	12.0	0.13	0.52	0.11	1.30	0.02	0.74	94	370	5	5	7	6	12	4	2.0
		0.66	21.0	7.3	0.19	0.66	0.16	0.82	0.02	0.74	68	410	5	4	7	6	11	4	4.0
		0.70	24.0	4.7	0.19	0.69	0.13	0.61	0.02	0.42	36	410	6	4	8	4	6	4	3.0
		0.66	22.0	7.2	0.18	0.67	0.14	0.47	0.02	0.68	49	370	<4	4	7	4	10	4	3.0
		0.67	19.0	8.6	0.19	0.64	0.14	0.85	0.02	0.52	62	340	5	4	7	3	8	4	3.0
		0.51	22.0	6.6	0.14	0.60	0.11	0.60	0.02	0.54	45	360	<4	4	5	4	8	3	2.0
		0.58	22.0	7.1	0.16	0.62	0.12	0.63	0.02	0.64	47	370	4	4	6	3	10	3	3.0
		0.56	19.0	8.1	0.16	0.61	0.12	0.67	0.02	0.81	64	340	4	4	5	5	12	3	3.0

Appendix IV. Concentrations of major elements (in percent) and trace elements (in parts per million, ppm).

Varve Yr	Yr. AD	% Al	% Ca	% Fe	% K	% Mg	% Na	% P	% Ti	% Mn	ppm As	ppm Ba	ppm Ce	ppm Co	ppm Cr	ppm Cu	ppm Ga	ppm La	ppm Li
		0.52	20.0	7.8	0.16	0.63	0.12	0.63	0.02	0.86	59	340	<4	4	5	3	12	3	3.0
		0.45	18.0	9.6	0.13	0.53	0.10	0.72	0.02	0.79	74	310	<4	4	4	3	11	3	2.0
		0.60	19.0	8.3	0.17	0.54	0.15	0.70	0.02	1.00	58	340	<4	4	5	5	14	3	2.0
		0.48	20.0	8.0	0.14	0.56	0.10	0.51	0.02	0.92	53	320	<4	4	6	4	13	3	3.0
		0.48	24.0	6.3	0.14	0.59	0.11	0.70	0.02	0.57	49	370	<4	4	6	4	8	3	2.0
		0.46	21.0	8.1	0.13	0.57	0.10	0.85	0.01	0.66	63	380	<4	4	4	4	10	3	2.0
		0.49	20.0	7.8	0.14	0.54	0.10	0.89	0.02	0.72	62	390	5	4	4	4	10	3	3.0
		0.64	21.0	8.3	0.20	0.58	0.13	0.89	0.02	1.40	73	430	4	5	5	5	21	4	4.0
		0.95	14.0	11.0	0.27	0.54	0.16	1.00	0.03	1.80	94	380	7	6	8	2	24	6	5.0
		1.00	12.0	12.0	0.28	0.52	0.16	1.10	0.04	1.50	92	330	9	6	9	6	23	6	5.0
		1.00	9.8	13.0	0.28	0.45	0.17	0.98	0.04	1.60	110	280	10	6	8	8	23	6	5.0
		0.77	15.0	11.0	0.22	0.53	0.14	0.73	0.03	1.20	80	290	8	5	7	9	17	5	4.0
		0.86	17.0	10.0	0.23	0.66	0.18	0.83	0.03	1.40	86	360	6	6	10	6	21	5	5.0
		0.80	16.0	10.0	0.22	0.60	0.17	0.62	0.03	2.00	82	360	6	5	9	4	29	5	4.0
		0.58	17.0	9.2	0.16	0.58	0.12	0.82	0.02	1.50	75	370	4	5	7	3	22	4	3.0
		0.71	20.0	6.8	0.20	0.69	0.15	0.66	0.03	0.81	61	380	5	4	8	6	12	4	4.0
		0.96	23.0	4.6	0.26	0.80	0.19	0.58	0.03	0.62	42	410	7	5	11	5	10	5	5.0
		0.95	22.0	4.6	0.26	0.75	0.20	0.57	0.03	0.69	41	400	6	5	11	5	11	5	5.0
		0.82	19.0	7.8	0.22	0.60	0.16	0.90	0.03	1.20	69	370	8	6	8	5	18	5	5.0
		0.56	19.0	8.0	0.15	0.60	0.13	0.76	0.02	0.68	64	330	<4	5	6	5	10	3	3.0
		0.44	19.0	10.0	0.13	0.56	0.10	1.10	0.01	0.67	74	480	<4	5	5	3	9	3	2.0
		0.42	21.0	7.6	0.12	0.60	0.10	0.81	0.01	0.45	66	370	<4	4	5	4	5	2	3.0
		0.59	20.0	9.7	0.16	0.56	0.12	0.91	0.02	0.70	75	340	4	4	6	5	10	4	3.0
		1.00	21.0	6.0	0.30	0.68	0.19	0.41	0.04	0.54	47	370	8	5	10	5	9	6	6.0
		0.77	21.0	7.2	0.21	0.65	0.16	0.76	0.03	0.56	58	360	7	5	8	3	7	5	4.0
770	1215	0.61	17.0	10.0	0.17	0.57	0.14	1.00	0.02	0.90	71	310	6	5	7	4	13	4	3.0
783	1202	0.49	16.0	11.0	0.14	0.52	0.11	1.00	0.02	0.97	78	380	4	5	6	4	14	3	2.0
792	1193	0.48	17.0	9.9	0.14	0.55	0.12	1.10	0.02	0.75	89	320	<4	4	7	7	10	3	3.0
804	1181	0.70	18.0	9.0	0.19	0.62	0.17	0.84	0.02	0.84	68	310	5	4	8	5	12	4	4.0
814	1171	0.70	18.0	8.8	0.19	0.61	0.16	0.79	0.02	1.00	66	320	5	6	8	6	16	4	3.0
826	1159	0.89	16.0	9.6	0.23	0.63	0.19	0.85	0.03	0.98	74	320	7	6	10	22	16	5	5.0
838	1147	2.00	16.0	8.1	0.47	0.80	0.35	0.65	0.08	0.97	58	360	21	9	27	13	20	12	11.0
845	1140	6.30	5.4	4.3	1.50	1.50	1.30	0.13	0.27	0.23	18	540	43	12	77	26	16	25	31.0
856	1129	0.46	18.0	9.8	0.14	0.60	0.12	0.79	0.02	0.92	80	310	5	6	7	6	16	4	3.0
870	1115	0.42	13.0	12.0	0.13	0.53	0.11	0.91	0.02	0.88	120	230	5	5	5	6	15	3	3.0
880	1105	0.44	16.0	11.0	0.14	0.56	0.10	0.86	0.02	0.99	97	280	4	4	5	7	16	3	3.0
895	1090	0.42	15.0	12.0	0.13	0.53	0.10	0.87	0.02	0.91	110	260	4	5	5	6	16	3	3.0
909	1076	0.41	17.0	11.0	0.12	0.60	0.10	0.85	0.02	0.86	99	280	<4	4	5	13	15	3	2.0
922	1063	0.45	16.0	12.0	0.13	0.59	0.10	0.78	0.02	1.00	110	290	6	5	5	6	17	3	3.0

Appendix IV. Concentrations of major elements (in percent) and trace elements (in parts per million, ppm).

Appendix IV. Concentrations of major elements (in percent) and trace elements (in parts per million, ppm).

Varve Yr	Yr. AD	% Al	% Ca	% Fe	% K	% Mg	% Na	% P	% Ti	% Mn	ppm As	ppm Ba	ppm Ce	ppm Co	ppm Cr	ppm Cu	ppm Ga	ppm La	ppm Li
934	1051	0.45	17.0	11.0	0.14	0.59	0.11	0.71	0.02	1.20	96	310	5	5	7	6	21	3	3.0
946	1039	0.50	12.0	13.0	0.14	0.52	0.11	0.88	0.02	1.50	110	250	5	6	6	7	26	3	3.0
960	1025	0.39	14.0	13.0	0.12	0.53	0.10	1.20	0.02	1.00	110	260	<4	5	5	8	17	3	2.0
974	1011	0.45	16.0	11.0	0.14	0.58	0.11	1.10	0.02	0.75	100	280	<4	5	6	5	13	3	2.0
987	998	0.60	20.0	8.1	0.18	0.70	0.14	0.63	0.02	0.82	79	350	5	5	9	9	15	4	4.0
999	986	0.54	15.0	11.0	0.15	0.55	0.11	1.00	0.02	1.40	98	310	7	5	7	9	24	4	3.0
1014	971	0.60	11.0	14.0	0.17	0.49	0.12	1.20	0.02	1.80	110	260	6	6	8	7	29	4	4.0
1025	960	0.47	15.0	13.0	0.14	0.57	0.11	0.88	0.02	0.99	100	260	5	5	7	6	17	4	3.0
1040	945	0.51	18.0	10.0	0.15	0.66	0.12	0.84	0.02	0.83	77	300	5	5	8	4	14	3	3.0
1054	931	0.50	18.0	10.0	0.15	0.64	0.12	0.69	0.02	0.91	85	300	4	4	7	6	15	3	3.0
1065	920	0.63	17.0	9.4	0.20	0.70	0.15	0.73	0.02	0.98	69	300	6	5	10	9	16	4	4.0
1078	907	0.58	20.0	8.1	0.19	0.75	0.15	0.78	0.02	0.92	75	350	5	4	8	5	17	3	4.0
1091	894	0.54	16.0	9.6	0.18	0.65	0.15	0.96	0.02	0.90	95	290	4	4	9	8	15	4	4.0
1102	883	0.63	20.0	7.9	0.20	0.72	0.16	0.72	0.02	1.00	80	320	5	5	10	9	17	4	5.0
1114	871	0.58	14.0	11.0	0.20	0.61	0.16	0.89	0.03	1.30	100	280	7	6	10	14	24	4	5.0
1125	860	0.53	19.0	6.6	0.17	0.68	0.14	0.67	0.02	0.49	71	310	<4	4	8	5	8	3	3.0
1136	849	0.63	19.0	8.8	0.20	0.71	0.17	0.72	0.03	0.74	75	310	5	5	10	13	13	4	5.0
1146	839	0.41	18.0	8.4	0.13	0.57	0.11	0.76	0.02	1.00	89	290	3	5	7	7	18	3	2.0
1157	828	0.52	17.0	9.0	0.16	0.63	0.13	0.82	0.02	0.98	74	300	5	5	7	6	18	4	3.0
1169	816	0.42	16.0	9.5	0.13	0.59	0.11	1.10	0.02	0.60	73	250	<4	4	7	7	9	3	3.0
1185	800	0.44	17.0	9.7	0.15	0.62	0.12	1.10	0.02	0.62	82	280	4	4	7	7	10	3	3.0
1199	786	0.48	21.0	7.4	0.15	0.72	0.12	0.89	0.02	0.51	67	330	4	4	7	6	8	3	3.0
1211	774	0.52	22.0	6.9	0.15	0.72	0.12	0.85	0.02	0.47	57	330	4	4	8	7	8	4	3.0
1224	761	0.52	21.0	6.3	0.17	0.74	0.14	0.56	0.02	0.56	60	320	<4	3	8	3	10	3	3.0
1237	748	0.52	22.0	6.9	0.16	0.75	0.13	0.50	0.02	0.55	62	330	<4	4	8	3	8	4	3.0
1250	735	0.61	21.0	6.8	0.20	0.77	0.17	0.50	0.02	0.49	60	310	5	4	10	8	8	4	4.0
1265	720	0.47	21.0	7.4	0.15	0.70	0.12	0.73	0.02	0.59	61	330	<4	4	8	13	12	3	4.0
1277	708	0.40	15.0	12.0	0.11	0.52	0.10	1.10	0.01	0.56	89	230	<4	5	6	1	8	2	2.0
1292	693	0.35	14.0	11.0	0.11	0.50	0.09	1.10	0.01	0.73	89	240	<4	5	6	29	12	3	2.0
1305	680	0.27	11.0	14.0	0.08	0.39	0.07	1.40	0.01	1.10	110	210	<4	5	5	6	18	3	1.4
1319	666	0.41	13.0	13.0	0.12	0.48	0.10	1.10	0.02	0.91	110	230	5	5	7	3	15	3	2.0
1334	651	0.38	12.0	13.0	0.12	0.47	0.10	1.20	0.02	1.10	110	240	6	5	7	9	19	3	3.0
1349	636	0.41	9.7	15.0	0.12	0.44	0.10	1.40	0.01	1.20	110	200	4	5	7	7	20	3	2.0
1368	617	0.44	11.0	13.0	0.13	0.48	0.11	1.30	0.02	1.00	110	220	4	5	7	10	18	3	3.0
1383	602	0.32	16.0	9.7	0.10	0.51	0.08	0.93	0.01	0.88	76	290	4	4	5	6	14	3	2.0
1400	585	0.29	13.0	12.0	0.08	0.45	0.07	1.20	0.01	1.00	80	240	<4	4	4	4	16	3	1.4
1416	569	0.33	13.0	11.0	0.10	0.49	0.08	1.00	0.01	0.94	84	240	<4	4	5	4	15	3	2.0
1430	555	0.45	14.0	10.0	0.13	0.51	0.10	0.88	0.02	0.93	72	270	<4	5	6	4	14	3	3.0
1445	540	0.44	14.0	11.0	0.12	0.51	0.09	0.68	0.01	1.20	68	260	4	5	6	5	18	3	3.0

Appendix IV. Concentrations of major elements (in percent) and trace elements (in parts per million, ppm).

Varve Yr	Yr. AD	% Al	% Ca	% Fe	% K	% Mg	% Na	% P	% Ti	% Mn	ppm As	ppm Ba	ppm Ce	ppm Co	ppm Cr	ppm Cu	ppm Ga	ppm La	ppm Li
1459	526	0.45	15.0	11.0	0.13	0.54	0.10	0.92	0.02	1.00	72	300	<4	5	6	5	15	3	3.0
1471	514	0.56	18.0	9.4	0.16	0.65	0.13	0.76	0.02	0.91	63	310	5	5	7	8	14	4	3.0
1486	499	0.48	16.0	10.0	0.14	0.59	0.12	0.73	0.02	1.20	65	300	4	5	6	6	17	4	3.0
1498	487	0.51	16.0	10.0	0.15	0.59	0.13	0.73	0.02	1.30	66	390	4	5	7	9	20	4	3.0
1506	479	0.76	17.0	9.7	0.21	0.67	0.16	0.80	0.03	0.73	68	460	7	5	10	1	11	5	4.0
1519	466	0.62	16.0	9.2	0.17	0.64	0.14	0.66	0.02	1.00	67	370	6	6	9	12	17	4	4.0
1532	453	0.63	19.0	7.3	0.18	0.71	0.15	0.54	0.02	0.91	61	330	5	5	9	4	14	4	3.0

Appendix IV. Concentrations of major elements (in percent) and trace elements (in parts per million, ppm).

Varve Yr ppm Mo ppm Ni

Appendix IV. Concentrations of major elements (in percent) and trace elements (in parts per million, ppm).

Varve Yr	ppm Mo	ppm Ni	ppm Pb	ppm Sr	ppm V	ppm Zn
75	<2	7	11	100	18	55
80	<2	4	11	96	16	48
86	<2	5	10	110	17	49
92	3	4	10	130	13	33
97	3	3	6	130	11	25
102	<2	3	5	110	10	25
110	2	2	<4	99	9	32
118	2	3	<4	160	10	21
133	3	2	<4	170	10	20
142	3	3	<4	170	10	18
150	4	3	<4	160	11	22
159	3	3	<4	180	10	20
170	4	3	<4	180	10	27
180	4	3	<4	170	12	26
189	3	2	<4	160	10	20
200	4	3	<4	160	11	22
209	4	3	<4	160	12	25
220	3	4	<4	200	14	22
230	3	4	<4	200	14	19
244	2	4	<4	190	15	19
257	<2	4	<4	160	16	22
264	<2	10	<4	180	15	20
272	3	5	<4	200	18	22
282	3	5	<4	150	20	27
292	2	5	<4	130	20	26
302	<2	4	<4	170	17	22
311	<2	5	<4	160	18	24
321	3	5	<4	200	14	20
331	4	4	<4	200	12	23
343	5	4	<4	180	14	28
358	4	4	<4	200	12	23
370	2	5	<4	190	11	22
380	<2	4	<4	180	15	19
392	3	4	<4	190	14	22
404	3	3	<4	200	12	20
415	3	4	<4	170	13	20
425	<2	3	<4	160	13	20
435	<2	4	<4	170	15	18
449	<2	2	<4	170	12	20

Appendix IV. Concentrations of major elements (in percent) and trace elements (in parts per million, ppm).

Varve Yr	ppm Mo	ppm Ni	ppm Pb	ppm Sr	ppm V	ppm Zn
460	<2	3	<4	180	12	18
471	3	4	<4	190	14	20
482	<2	2	<4	160	11	18
493	3	3	<4	140	11	18
504	2	2	<4	140	12	20
517	<2	3	<4	140	11	20
529	3	3	<4	190	11	20
539	2	4	<4	190	12	22
550	2	3	<4	160	11	18
564	2	4	<4	180	12	23
575	3	4	<4	160	16	24
588	<2	4	<4	130	20	26
599	<2	4	<4	120	17	25
614	2	4	<4	120	16	27
626	<2	4	<4	120	13	25
637	<2	6	<4	140	18	29
648	<2	4	<4	130	16	22
660	2	4	<4	150	14	25
668	4	4	<4	170	15	21
672	<2	7	<4	200	19	24
687	<2	4	<4	190	16	22
697	2	6	<4	190	19	26
709	3	3	<4	150	14	18
719	2	5	<4	170	11	21
731	2	3	<4	150	11	17
743	<2	3	<4	180	10	18
753	<2	2	<4	150	13	30
764	<2	5	<4	180	16	22
775	2	5	<4	180	16	22
787	2	3	<4	150	16	19
	<2	2	<4	140	13	29
	<2	2	<4	140	13	41
	2	5	<4	190	13	25
	2	4	<4	200	12	20
	<2	3	<4	180	12	18
	<2	4	<4	170	12	20
	<2	2	<4	170	10	16
	<2	3	<4	190	11	17
	3	3	<4	160	11	17

Appendix IV. Concentrations of major elements (in percent) and trace elements (in parts per million, ppm).

Appendix IV. Concentrations of major elements (in percent) and trace elements (in parts per million, ppm).

Varve Yr	ppm Mo	ppm Ni	ppm Pb	ppm Sr	ppm V	ppm Zn
	3	3	<4	170	10	16
	3	3	<4	150	9	17
	2	4	<4	150	10	23
	2	4	<4	160	10	17
	2	4	<4	200	10	18
	<2	3	<4	180	10	28
	<2	4	<4	170	10	22
	4	4	<4	190	12	20
	<2	5	<4	140	17	35
	<2	5	<4	120	17	27
	2	4	<4	99	15	27
	2	4	<4	130	13	52
	3	6	<4	140	15	39
	<2	5	<4	140	14	130
	3	4	<4	150	12	21
	4	4	<4	180	15	21
	<2	5	<4	200	17	62
	<2	6	<4	200	16	21
	3	5	<4	170	15	38
	2	3	<4	160	11	37
	<2	4	<4	170	9	19
	3	3	<4	180	8	16
	<2	3	<4	160	11	34
	2	6	<4	180	16	26
	2	5	<4	180	13	27
770	2	4	<4	140	11	77
783	2	3	<4	140	11	35
792	3	4	<4	150	11	25
804	2	4	<4	160	13	37
814	3	3	<4	160	14	38
826	3	6	<4	150	18	22
838	<2	15	<4	160	33	46
845	<2	30	11	220	71	67
856	2	4	<4	160	13	61
870	4	3	<4	120	10	110
880	3	3	<4	140	11	20
895	3	2	<4	130	10	19
909	2	2	<4	150	9	19
922	4	2	<4	140	11	17

Varve Yr	ppm Mo	ppm Ni	ppm Pb	ppm Sr	ppm V	ppm Zn
934	2	2	<4	150	11	17
946	4	2	<4	120	12	24
960	4	2	<4	130	10	23
974	3	3	<4	140	11	19
987	2	3	<4	180	13	20
999	3	3	<4	140	13	23
1014	2	3	<4	98	14	26
1025	2	2	<4	130	12	17
1040	2	3	<4	150	11	19
1054	2	3	<4	150	12	18
1065	2	6	<4	150	13	18
1078	3	4	<4	180	13	21
1091	3	4	<4	150	14	26
1102	2	4	<4	170	16	22
1114	4	4	<4	130	18	31
1125	3	3	<4	170	12	19
1136	2	4	<4	170	14	25
1146	2	3	<4	150	10	21
1157	3	4	<4	150	12	21
1169	3	2	<4	140	11	19
1185	3	3	<4	150	12	21
1199	3	3	<4	190	12	20
1211	2	3	<4	190	11	18
1224	3	3	<4	180	12	19
1237	2	3	<4	190	12	16
1250	3	5	<4	190	14	19
1265	3	4	<4	180	12	16
1277	2	2	<4	120	9	19
1292	2	2	<4	120	10	20
1305	<2	3	<4	92	8	49
1319	3	2	<4	110	10	22
1334	4	3	<4	110	11	20
1349	4	2	<4	92	11	25
1368	5	3	<4	110	11	23
1383	3	3	<4	150	10	20
1400	3	5	<4	120	9	19
1416	5	2	<4	120	10	23
1430	4	2	<4	130	11	24
1445	2	2	<4	120	12	18

Appendix IV. Concentrations of major elements (in percent) and trace elements (in parts per million, ppm).

Varve Yr	ppm Mo	ppm Ni	ppm Pb	ppm Sr	ppm V	ppm Zn
1459	2	3	<4	130	11	17
1471	2	2	<4	150	13	19
1486	3	2	<4	140	12	15
1498	3	2	<4	150	13	17
1506	<2	4	<4	160	15	17
1519	3	3	<4	160	14	19
1532	5	4	<4	170	13	17

Appendix V. Concentrations of diatoms in number of specimens per millimeter of transect across a microscope slide.

Abbreviations:

trans.	length of transect (mm)
count	total number of diatoms in count
d/mm	diatoms per millimeter of transect
ach	*Achnanthes* species
amph	*Amphora perpusilla*
astfor	*Asterionella formosa*
auital	*Aulacoseira italica*
auamb	*Aulacoseira ambigua*
augran	*Aulacoseira granulata*
coplac	*Cocconeis placentula*
cybod	*Cyclotella bodanica*
cymich	*Cyclotella michiganiana*
cystell	*Cyclotella stelligera*
cykram	*Cyclotella krammeri*
cymb	*Cymbella* species
dip	*Diploneis* species
epith	*Epithemia* species
eun	*Eunotia* species
frcrot	*Fragilaria crotonensis*
frvauch	*Fragilaria vaucheriae*
frcap	*Fragilaria capucina*
froth	*Staurosira* + *Pseudostaurosira* + *Staruosirella* species
gomph	*Gomphonema* species
gyro	*Gyrosigma* species
navic	*Navicula* species
neid	*Neidium* species
nitz	*Nitzschia* species
pin	*Pinnularia* species
ropal	*Rhopalodia* species
rhzeri	*Rhizosolenia eriensis*
stalp	*Stephanodiscus alpinus*
stmin	*Stephanodiscus minutulus*
stniag	*Stephanodiscus niagarae*
syacus	*Synedra acus*
synana	*Synedra nana*
syrump	*Synedra rumpens*
syuln	*Synedra ulna*
syuinc	*Synedra ulna* v. *chaseana*
sycycl	*Synedra cyclopum*
sypara	*Synedra parasitica*
surir	*Surirella* species
staura	*Stauroneis* species
tabflo	*Tabelleria flocculosa*
ch-sum	charcoal
phyto	opal phytoliths

cyst	Chrysophyte cysts
scale	Chrysophyte scales
spic	sponge spicules

Appendix V. Concentrations of diatoms in number of specimens per millimeter of transect across a microscope slide.

Spl.	Yr. AD	Varve-Yr	trans	count	d/mm	ach	amph	astfor	auital	auamb	augran	coplac	cybod	cymich	cystell	cykram	cymb	dip	epith	eun
1	1982	2	12.9	510	40	0	0	4	0	0	0	0	3	3	1	0	0	0	0	0
2	1979	5	10.6	521	49	1	1	5	0	0	0	0	2	2	1	0	0	0	0	0
3	1976	8	13.0	547	42	0	0	5	0	1	0	0	3	3	0	0	0	0	0	0
4	1973	11	10.3	596	58	0	0	8	0	3	0	0	5	2	1	0	0	0	0	0
5	1971	13	11.0	516	47	0	0	4	0	3	0	0	1	1	0	0	0	0	0	0
6	1967	17	12.0	562	47	1	0	3	0	3	0	0	1	0	1	0	0	0	0	0
7	1964	20	8.6	568	66	0	0	4	0	5	1	0	3	1	1	0	0	0	0	0
8	1961	23	12.2	739	61	1	0	7	0	4	0	1	3	2	0	0	1	0	0	0
9	1958	26	12.5	672	54	0	1	3	0	9	0	0	2	0	0	0	1	0	0	0
10	1954	30	7.6	601	79	1	1	7	0	11	0	0	4	0	0	0	1	0	0	0
11	1951	33	32.0	531	17	0	0	1	0	1	0	0	1	0	1	0	0	0	0	0
12	1948	36	17.0	561	33	0	0	1	0	3	0	1	1	0	0	0	0	0	0	0
13	1945	39	12.0	651	54	1	1	2	0	5	0	0	2	0	1	0	1	0	0	0
14	1942	42	15.8	502	32	0	0	2	0	2	1	0	2	0	0	0	1	0	0	0
15	1939	45	12.0	599	50	0	0	1	0	4	1	0	1	0	1	0	1	0	0	0
16	1936	48	8.4	718	85	1	0	3	0	7	0	1	6	1	1	0	2	0	0	0
17	1933	51	8.1	630	78	1	0	2	0	4	1	1	3	0	9	0	0	0	0	0
18	1930	54	10.1	788	78	0	0	2	0	7	0	0	4	0	0	0	1	0	1	0
19	1928	56	13.1	659	50	0	1	1	0	4	0	1	2	0	0	0	1	0	0	0
20	1925	59	13.0	697	54	0	0	1	0	6	0	0	1	0	0	0	0	0	0	0
21	1922	62	4.5	402	89	1	0	1	0	1	0	0	0	0	3	0	0	0	0	0
22	1919	65	2.7	527	195	1	0	5	0	4	0	0	0	0	1	0	1	0	1	0
23	1916	68	6.2	734	118	0	0	2	0	8	0	0	4	0	5	0	1	0	0	0
24	1913	71	8.8	610	69	0	0	1	0	4	0	0	3	0	3	0	0	0	0	0
25	1910	74	12.6	623	49	0	0	2	0	3	0	0	3	0	5	0	1	0	0	0
26	1908	76	12.5	700	56	1	0	2	0	4	0	0	6	0	2	0	1	0	0	0
27	1905	79	17.3	595	34	0	0	1	0	3	0	0	3	0	0	0	0	0	0	0
28	1902	82	17.7	628	35	1	0	2	0	3	0	0	3	0	0	0	0	0	0	0
29	1899	85	21.0	488	23	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0
30	1896	88	12.0	515	43	1	1	2	0	0	0	0	6	0	1	0	1	0	0	0
31	1893	91	9.0	587	65	0	0	5	0	0	0	0	4	0	0	0	0	0	0	0
32	1891	93	9.0	561	62	1	0	9	0	0	0	0	4	0	0	0	0	0	0	0
33	1888	96	12.5	525	42	0	0	3	0	0	0	0	2	0	0	0	1	0	0	0
34	1886	98	9.5	481	51	0	1	6	0	0	0	0	1	0	0	0	0	0	0	0
35	1883	101	7.2	546	76	0	0	11	0	0	0	1	1	0	0	0	0	0	0	0

Appendix V. Concentrations of diatoms in number of specimens per millimeter of transect across a microscope slide.

Spl.	Yr. AD	Varve-Yr	trans	count	d/mm	ach	amph	astfor	auital	auamb	augran	coplac	cybod	cymich	cystell	cykram	cymb	dip	epith	eun
36	1881	103	10.7	580	54	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0

Appendix V. Concentrations of diatoms in number of specimens per millimeter of transect across a microscope slide.

Spl.	Yr. AD	Varve-Yr	trans	count	d/mm	ach	amph	astfor	auital	auamb	augran	coplac	cybod	cymich	cystell	cykram	cymb	dip	epith	eun
36	1881	103	10.7	580	54	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
37	1878	106	16.8	372	22	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
38	1876	108	34.8	390	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39	1873	111	17.7	496	28	0	0	2	0	0	0	0	1	0	0	0	0	0	0	0
40	1871	113	10.4	492	47	0	0	2	0	0	0	0	2	1	0	0	0	0	0	0
41	1868	116	8.7	473	54	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0
42	1864	120	12.0	491	41	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0
43	1856	128	16.9	540	32	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
44	1850	134	11.0	545	50	0	0	6	0	0	0	0	1	3	0	0	0	0	0	0
45	1844	140	33.5	112	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
46	1839	145	32.0	476	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
47	1836	148	34.8	520	15	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
48	1832	152	17.1	503	29	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
49	1827	157	6.0	559	93	0	1	9	0	0	0	0	0	0	0	0	1	0	0	0
50	1822	162	6.3	552	88	0	0	21	0	0	0	0	0	0	0	0	1	0	0	0
51	1817	167	13.0	514	40	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
52	1811	173	15.8	578	37	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0
53	1806	178	9.4	558	59	0	0	29	0	0	0	0	0	0	0	0	0	0	0	0
54	1802	182	17.2	531	31	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0
55	1797	187	17.4	461	27	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0
56	1792	192	8.9	605	68	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0
57	1786	198	16.7	507	30	0	0	1	0	0	0	0	6	1	0	0	1	0	0	0
58	1782	202	9.8	574	59	0	1	1	0	0	0	0	2	1	0	0	1	0	0	0
59	1778	206	12.4	444	36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60	1773	211	14.8	579	39	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
61	1767	217	9.3	498	54	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0
62	1762	222	22.5	483	22	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0
63	1757	227	35.4	69	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
64	1751	233	34.7	79	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65	1746	238	34.9	217	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
66	1742	242	34.9	165	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
67	1738	246	34.3	440	13	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
68	1734	250	35.2	195	6	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
69	1729	255	34.3	122	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
70	1725	259	35.6	173	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix V. Concentrations of diatoms in number of specimens per millimeter of transect across a microscope slide.

Spl.	Yr. AD	Varve-Yr	trans	count	d/mm	ach	amph	astfor	auital	auamb	augran	coplac	cybod	cymich	cystell	cykram	cymb	dip	epith	eun
71	1722	262	35.5	100	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
72	1718	266	35.2	375	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
73	1714	270	17.5	396	23	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
74	1710	274	21.6	495	23	0	0	3	0	0	0	0	0	0	0	0	1	0	0	0
75	1705	279	35.2	154	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
76	1700	284	34.7	186	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
77	1694	290	17.5	350	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
78	1689	295	34.6	323	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
79	1685	299	9.3	502	54	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0
80	1680	304	24.3	458	19	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
81	1675	309	30.5	524	17	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
82	1671	313	10.2	469	46	0	0	20	0	0	0	0	0	0	0	0	0	0	0	0
83	1666	318	35.6	187	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
84	1661	323	8.4	510	61	0	1	4	0	0	0	0	0	0	0	0	1	0	0	1
85	1656	328	6.3	503	80	1	1	16	0	0	0	0	0	0	0	0	1	0	0	1
86	1650	334	15.7	541	34	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
87	1644	340	6.0	473	79	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0
88	1637	347	23.5	509	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
89	1629	355	11.4	387	34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
90	1622	362	17.4	387	22	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0
91	1617	367	49.6	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
92	1612	372	36.0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
93	1606	378	36.0	25	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
94	1601	383	36.0	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
95	1595	389	36.0	58	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
96	1589	395	15.1	490	32	0	0	2	0	0	0	0	1	0	0	0	0	0	0	0
97	1583	401	7.0	524	75	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0
98	1577	407	35.8	459	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
99	1571	413	20.0	447	22	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
100	1567	417	14.7	473	32	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
101	1561	423	6.7	474	71	1	0	4	0	0	0	0	0	0	0	0	0	1	0	0
102	1557	427	17.3	420	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
103	1552	432	35.6	122	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
104	1545	439	35.5	195	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
105	1538	446	34.8	442	13	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0

Appendix V. Concentrations of diatoms in number of specimens per millimeter of transect across a microscope slide.

Spl.	Yr. AD	Varve-Yr	trans	count	d/mm	ach	amph	astfor	auital	auamb	augran	coplac	cybod	cymich	cystell	cykram	cymb	dip	epith	eun
106	1532	452	18.0	494	27	0	0	1	0	0	0	0	1							

Appendix V. Concentrations of diatoms in number of specimens per millimeter of transect across a microscope slide.

Spl.	Yr. AD	Varve-Yr	trans	count	d/mm	ach	amph	astfor	auital	auamb	augran	coplac	cybod	cymich	cystell	cykram	cymb	dip	epith	eun
106	1532	452	18.0	494	27	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0
107	1526	458	17.2	484	28	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0
108	1522	462	12.1	475	39	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0
109	1516	468	11.8	514	44	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
110	1510	474	19.5	458	23	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
111	1504	480	35.4	325	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
112	1499	485	9.5	445	47	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0
113	1493	491	32.5	449	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
114	1488	496	27.5	461	17	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0
115	1483	501	35.5	206	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
116	1477	507	35.2	185	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
117	1470	514	35.2	417	12	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
118	1464	520	35.1	241	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
119	1457	527	35.5	134	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
120	1452	532	35.6	78	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
121	1447	537	34.9	203	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
122	1443	541	35.0	308	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
123	1437	547	36.0	494	14	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0
124	1430	554	17.0	541	32	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0
125	1423	561	11.9	528	44	0	1	11	0	0	0	0	1	9	3	0	0	0	0	0
126	1416	568	35.2	73	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
127	1411	573	34.0	18	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
128	1405	579	35.2	313	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
129	1399	585	36.0	113	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
130	1393	591	35.8	254	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
131	1388	596	35.0	320	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
132	1381	603	35.0	304	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
133	1373	611	22.6	468	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
134	1367	617	14.1	479	34	0	0	1	0	0	0	0	2	0	0	0	0	0	0	0
135	1361	623	35.6	568	16	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
136	1355	629	25.1	451	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
137	1350	634	35.0	199	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
138	1344	640	35.1	371	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
139	1339	645	35.8	153	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
140	1332	652	17.0	378	22	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0

Appendix V. Concentrations of diatoms in number of specimens per millimeter of transect across a microscope slide.

Spl.	Yr. AD	Varve-Yr	trans	count	d/mm	ach	amph	astfor	auital	auamb	augran	coplac	cybod	cymich	cystell	cykram	cymb	dip	epith	eun
141	1326	658	14.5	579	40	0	0	4	0	0	0	0	2	0	0	0	0	0	0	0
142	1322	662	26.8	467	17	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0
143	1317	667	17.6	536	31	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0
144	1314	670	15.7	490	31	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
145	1310	674	10.5	526	50	0	0	1	0	10	0	0	0	0	0	0	0	0	0	0
146	1305	679	8.2	502	61	0	0	5	0	9	0	0	0	0	0	0	0	0	0	0
147	1299	685	7.0	440	63	1	0	3	0	7	0	0	0	0	0	0	1	0	0	0
148	1294	690	6.6	470	71	0	0	3	0	0	0	0	4	0	0	0	0	0	0	0
149	1289	695	5.7	503	88	1	0	2	0	0	0	0	0	0	0	0	1	0	0	0
150	1284	700	7.8	583	75	1	1	8	0	0	13	0	1	0	0	0	0	0	0	0
151	1278	706	22.6	316	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
152	1272	712	10.5	447	43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
153	1267	717	17.5	341	19	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
154	1263	721	17.8	453	25	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
155	1257	727	14.3	410	29	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
156	1249	735	17.9	321	18	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
157	1243	741	10.5	475	45	0	1	8	0	0	0	0	1	2	0	0	1	0	0	0
158	1238	746	3.5	476	136	1	0	17	0	0	0	0	0	0	0	0	0	0	0	0
159	1234	750	7.5	383	51	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
160	1228	756	13.1	392	30	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0
161	1222	762	3.0	468	156	0	1	5	0	0	0	0	0	0	0	0	0	0	0	0
162	1217	767	4.2	433	103	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
163	1212	772	26.1	418	16	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
164	[illegible]	[illegible]	4.2	511	122	0	1	5	0	0	0	0	3	0	0	0	0	1	0	0
165	[illegible]	[illegible]	17.7	413	23	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
166	[illegible]	[illegible]	17.9	573	32	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
167	[illegible]	[illegible]	22.0	361	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
168	[illegible]	[illegible]	34.9	194	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
169	[illegible]	[illegible]	17.6	424	24	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
170	[illegible]	[illegible]	27.3	423	16	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0
171	1205	780	34.7	323	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
172	1200	785	34.6	270	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
173	1196	789	5.4	374	69	1	0	2	0	0	0	1	1	1	0	0	1	0	0	0
174	1190	795	9.0	470	52	0	1	3	0	0	0	0	1	3	0	0	1	0	0	1
175	1184	801	14.6	475	33	0	0	1	0	0	0	0	1	2	0	0	0	0	0	0

Appendix V. Concentrations of diatoms in number of specimens per millimeter of transect across a microscope slide.

Spl. Yr. AD Varve-Yr trans count d/mm ach amph astfor auital auamb augran coplac cybod cymich cystell cykram

Appendix V. Concentrations of diatoms in number of specimens per millimeter of transect across a microscope slide.

Spl.	Yr. AD	Varve-Yr	trans	count	d/mm	ach	amph	astfor	auital	auamb	augran	coplac	cybod	cymich	cystell	cykram	cymb	dip	epith	eun
176	1178	807	10.0	453	45	1	0	4	0	0	0	0	0	0	0	0	0	0	0	0
177	1174	811	6.5	474	73	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0
178	1168	817	11.2	467	42	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
179	1162	823	9.6	483	50	0	0	11	0	0	0	0	0	0	0	0	0	0	0	0
180	1156	829	14.2	445	31	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0
181	1150	835	8.0	424	53	0	0	4	0	0	0	0	1	0	0	0	1	0	0	1
182	1144	841	14.6	356	24	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
183	1142	843	34.8	198	6	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
184	1138	847	17.8	513	29	0	0	11	0	0	0	0	0	0	0	0	0	0	0	0
185	1132	853	11.7	464	40	1	0	3	0	0	0	0	1	0	0	0	0	0	0	0
186	1126	859	17.8	422	24	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0
187	1118	867	12.0	453	38	1	0	1	0	0	0	0	5	2	0	0	1	0	0	0
188	1113	872	12.6	454	36	0	0	4	0	0	0	0	1	2	0	0	0	0	0	0
189	1108	877	5.0	355	71	0	0	4	0	0	0	0	2	0	0	0	0	0	0	0
190	1102	883	17.8	396	22	0	0	2	0	0	0	0	1	0	0	0	0	0	0	0
191	1093	892	10.0	435	44	0	0	3	0	0	0	0	1	0	0	0	0	0	0	0
192	1086	899	16.3	398	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
193	1080	905	35.6	283	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
194	1073	912	35.6	353	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
195	1066	919	35.6	218	6	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0
196	1060	925	35.6	217	6	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0
197	1053	932	35.6	304	9	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
198	1049	936	35.6	83	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
199	1043	942	35.6	56	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
200	1035	950	33.6	155	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
201	1028	957	35.4	377	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
202	1021	964	15.2	424	28	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0
203	1014	971	26.3	470	18	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
204	1007	978	11.0	387	35	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0
205	1000	985	25.7	379	15	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
206	995	990	8.0	503	63	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
207	989	996	17.4	432	25	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
208	982	1003	17.1	454	27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
209	975	1010	18.1	258	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
210	968	1017	35.6	116	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix V. Concentrations of diatoms in number of specimens per millimeter of transect across a microscope slide.

Spl.	Yr. AD	Varve-Yr	trans	count	d/mm	ach	amph	astfor	auital	auamb	augran	coplac	cybod	cymich	cystell	cykram	cymb	dip	epith	eun
211	962	1023	36.0	92	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
212	957	1028	36.0	154	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
213	949	1036	35.0	134	4	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
214	941	1044	35.6	42	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
215	934	1051	36.0	208	6	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
216	928	1057	18.0	510	28	0	0	1	0	0	0	0	3	1	0	0	0	0	0	0
217	923	1062	35.6	418	12	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
218	916	1069	17.6	365	21	0	0	1	0	0	1	0	2	0	0	0	0	0	0	0
219	910	1075	17.8	464	26	0	0	1	0	0	0	0	2	0	0	0	0	0	0	0
220	903	1082	27.0	398	15	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0
221	896	1089	10.0	436	44	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
222	891	1094	17.0	625	37	0	0	10	0	0	0	0	0	0	0	0	1	0	0	0
223	886	1099	7.8	444	57	1	0	14	0	0	13	0	0	0	0	0	0	0	0	0
224	880	1105	17.8	424	24	0	0	4	0	0	1	0	0	0	0	0	1	0	0	0
225	875	1110	12.5	446	36	0	0	3	0	0	0	0	0	0	0	0	1	0	0	0
226	868	1117	15.1	443	29	0	0	3	0	0	1	0	0	0	0	0	1	0	0	0
227	862	1123	17.1	654	38	1	0	5	0	0	6	0	1	0	0	0	1	0	0	0
228	857	1128	12.7	473	37	0	0	8	0	0	7	0	0	0	0	0	1	0	0	0
229	851	1134	17.5	366	21	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
230	846	1139	11.8	518	43	1	1	4	0	0	0	0	1	0	0	0	2	0	0	0
231	841	1144	7.4	509	69	1	1	2	0	0	0	1	3	0	0	1	0	0	0	0
232	836	1149	9.4	306	33	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
233	831	1154	30.7	461	15	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
234	825	1160	17.6	382	22	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
235	819	1166	17.3	425	25	0	1	3	0	0	0	0	0	0	0	0	1	0	0	0
236	812	1173	17.8	428	24	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0
237	805	1180	17.6	371	21	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
238	795	1190	17.8	309	17	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
239	789	1196	11.2	421	38	0	0	3	0	0	0	0	0	1	0	0	1	0	0	0
240	782	1203	17.5	390	22	0	1	1	0	0	0	0	1	0	0	0	1	0	0	0
241	776	1209	11.0	397	36	1	0	3	0	0	0	0	0	0	0	0	1	0	0	0
242	771	1214	11.3	488	43	1	0	15	0	0	0	0	1	1	0	0	1	0	0	0
243	764	1221	2.6	379	146	1	1	13	0	0	0	1	0	1	0	0	1	0	0	0
244	758	1227	9.8	415	42	0	0	9	0	0	0	0	1	0	0	0	1	0	0	0
245	752	1233	10.2	427	42	1	1	2	0	0	0	0	3	0	0	0	2	0	0	0

Appendix V. Concentrations of diatoms in number of specimens per millimeter of transect across a microscope slide.

Appendix V. Concentrations of diatoms in number of specimens per millimeter of transect across a microscope slide.

Spl.	Yr. AD	Varve-Yr	trans	count	d/mm	ach	amph	astfor	auital	auamb	augran	coplac	cybod	cymich	cystell	cykram	cymb	dip	epith	eun
246	744	1241	17.8	339	19	0	1	4	0	0	0	0	1	0	0	0	1	0	0	0
247	738	1247	17.9	325	18	1	0	5	0	0	0	0	1	0	0	0	1	0	0	0
248	731	1254	14.0	362	26	0	0	3	0	0	0	0	1	0	0	0	1	0	0	0
249	723	1262	12.0	399	33	0	1	3	0	0	0	0	1	0	0	0	0	0	0	0
250	716	1269	13.0	371	29	0	0	3	0	0	0	0	1	0	0	0	1	0	0	0
251	711	1274	15.0	389	26	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0
252	704	1281	17.9	392	22	0	0	4	0	0	0	0	1	0	0	0	1	0	0	0
253	696	1289	5.8	418	72	0	0	5	0	0	0	0	2	0	0	0	2	0	0	0
254	689	1296	12.1	419	35	0	0	7	0	0	0	0	1	0	0	0	0	0	0	0
255	683	1302	24.1	327	14	0	0	3	0	0	0	0	2	0	0	0	0	0	0	0
256	677	1308	18.0	330	18	0	0	1	0	0	0	0	5	0	0	0	1	0	0	0
257	670	1315	17.8	414	23	0	0	4	0	0	0	0	2	0	0	0	1	0	0	0
258	662	1323	5.6	362	65	0	0	8	0	0	0	1	6	1	0	0	1	0	1	0
259	655	1330	5.5	381	69	0	0	0	0	0	0	1	2	0	0	0	0	0	1	0
260	647	1338	10.7	434	41	0	0	1	0	0	0	0	1	3	0	0	2	0	1	0
261	641	1344	36.0	281	8	0	1	0	0	0	0	0	2	0	0	0	0	0	0	0
262	631	1354	17.7	359	20	0	1	0	0	0	0	0	4	0	0	0	1	0	0	0
263	622	1363	35.5	162	5	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
264	612	1373	11.6	437	38	0	0	7	0	0	0	0	8	0	0	0	2	0	1	0
265	605	1380	18.0	394	22	0	0	4	0	0	0	0	4	0	0	0	0	0	0	0
266	598	1387	17.6	368	21	0	0	1	0	0	0	0	2	0	0	0	0	0	0	0
267	590	1395	26.8	339	13	0	1	1	0	0	0	0	6	0	0	0	1	0	0	0
268	580	1405	17.6	448	25	0	0	2	0	0	0	0	7	0	0	0	2	0	0	0
269	571	1414	14.4	379	26	0	0	7	0	0	0	0	3	0	0	0	1	0	0	0
270	567	1418	17.7	437	25	0	0	2	0	0	0	0	4	0	0	0	1	0	0	0
271	559	1426	17.9	366	20	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0
272	550	1435	17.8	467	26	0	0	2	0	0	0	0	3	0	0	0	1	0	0	0
273	542	1443	35.6	202	6	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
274	537	1448	35.6	173	5	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0
275	529	1456	35.6	247	7	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0
276	523	1462	35.6	224	6	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0
277	517	1468	32.6	355	11	0	0	1	0	0	0	0	3	0	0	0	0	0	0	0
278	510	1475	30.3	356	12	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0
279	502	1483	36.0	294	8	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0
280	495	1490	22.7	319	14	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0

Appendix V. Concentrations of diatoms in number of specimens per millimeter of transect across a microscope slide.

Spl.	Yr. AD	Varve-Yr	trans	count	d/mm	ach	amph	astfor	auital	auamb	augran	coplac	cybod	cymich	cystell	cykram	cymb	dip	epith	eun
281	489	1496	13.4	332	25	0	1	2	0	0	0	0	5	0	0	0	1	0	0	0
282	485	1500	9.1	340	37	0	1	4	0	0	0	0	5	0	0	0	0	0	0	0
283	481	1504	11.5	334	29	0	0	3	0	0	0	0	1	0	0	0	0	0	0	0
284	476	1509	15.7	375	24	0	1	3	0	0	0	0	1	0	0	0	1	0	0	0
285	469	1516	12.1	358	30	0	1	6	0	0	0	0	0	0	0	0	0	0	0	0
286	462	1523	12.3	498	40	0	0	2	0	0	0	0	1	1	0	2	1	0	1	0
287	456	1529	11.6	369	32	0	1	0	0	0	0	0	1	2	0	0	1	0	1	0
288	450	1535	9.0	414	46	0	1	1	0	0	0	0	1	0	0	0	1	0	1	0

Appendix V. Concentrations of diatoms in number of specimens per millimeter of transect across a microscope slide.

Spl. frcrot fryauch frcap froth

Appendix V. Concentrations of diatoms in number of specimens per millimeter of transect across a microscope slide.

Spl.	frcrot	frvauch	frcap	froth	gomph	gyro	navic	neid	nitz	pin	ropal	rhzeri	stalp	stmin	stniag	syacus	synana	syrump	syuln	syulnc	sycycl
1	20	1	0	0	0	0	0	0	0	0	0	0	0	2	1	1	0	0	0	0	0
2	28	1	0	0	0	0	0	0	0	0	0	0	0	2	1	1	1	0	0	0	0
3	18	0	0	0	1	0	0	0	0	0	0	0	1	0	1	4	0	0	0	0	0
4	22	1	1	0	0	0	0	0	0	0	0	0	0	1	3	6	0	0	0	0	0
5	25	0	0	0	0	0	1	0	0	0	0	0	1	1	1	7	1	0	0	0	0
6	18	0	0	1	0	0	0	0	1	0	0	0	1	10	1	3	1	0	0	0	0
7	34	0	0	0	1	0	1	0	0	0	1	0	0	5	2	3	0	0	0	0	0
8	21	1	0	1	0	0	1	0	1	0	0	1	1	4	1	3	1	0	0	1	0
9	19	1	0	1	0	0	1	0	1	0	0	0	0	4	2	2	0	0	0	1	0
10	35	1	1	0	1	0	1	0	1	0	0	0	1	7	1	1	0	0	0	1	0
11	5	1	0	0	0	0	0	0	0	0	0	0	0	2	0	1	0	0	0	0	0
12	10	1	0	0	0	0	1	0	1	0	0	0	1	3	2	1	1	0	0	1	0
13	13	1	1	0	1	0	0	0	1	0	0	0	1	8	0	3	0	1	0	1	0
14	6	0	1	0	1	0	0	0	1	0	0	1	1	3	0	2	0	0	0	0	0
15	10	1	0	0	1	0	1	0	1	0	0	0	2	11	1	2	1	0	0	1	0
16	16	1	1	0	0	0	1	0	1	0	0	0	2	20	2	5	5	0	0	2	0
17	22	2	2	0	0	0	1	0	1	0	0	0	3	12	1	3	1	1	0	2	0
18	27	1	0	1	1	0	2	0	1	0	0	0	3	8	1	5	2	1	0	1	0
19	15	1	0	0	1	0	2	0	1	0	0	0	2	8	1	3	1	0	0	1	0
20	17	1	1	0	1	0	0	0	1	0	0	0	2	5	0	2	0	0	0	1	0
21	69	1	0	0	0	0	1	0	1	0	0	0	0	2	0	2	3	0	0	0	0
22	159	1	0	0	0	0	1	0	1	0	0	0	0	3	0	1	4	1	0	0	0
23	25	2	1	0	1	0	0	0	1	0	0	0	3	15	2	8	32	1	0	2	0
24	12	1	1	1	1	0	0	0	0	0	0	0	1	8	2	3	27	0	0	1	0
25	16	1	2	0	0	0	1	0	0	0	0	0	1	2	3	2	1	1	0	1	0
26	17	1	3	1	1	0	1	0	0	0	0	0	3	3	3	1	1	0	0	1	0
27	11	1	3	0	0	0	0	0	0	0	0	0	1	2	1	3	0	0	0	1	0
28	11	1	3	0	0	0	0	0	0	0	0	0	2	4	2	2	0	0	0	1	0
29	7	1	1	0	0	0	0	0	0	0	0	0	1	3	1	1	0	0	0	0	0
30	18	1	1	0	0	0	1	0	0	0	0	0	3	2	1	1	1	0	0	0	0
31	36	2	1	0	1	0	0	0	0	0	0	0	2	5	0	3	1	0	0	0	0
32	29	1	0	0	0	0	1	0	0	0	0	0	1	6	0	2	1	1	0	1	0
33	26	0	0	0	0	0	1	0	0	0	0	0	0	1	0	1	1	0	0	0	0
34	34	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	0	0	0
35	13	0	0	0	0	0	0	0	0	0	0	0	0	41	0	2	1	0	0	1	0

Appendix V. Concentrations of diatoms in number of specimens per millimeter of transect across a microscope slide.

Spl.	frcrot	frvauch	frcap	froth	gomph	gyro	navic	neid	nitz	pin	ropal	rhzeri	stalp	stmin	stniag	syacus	synana	syrump	syuln	syulnc	sycycl
36	32	0	0	0	0	0	0	0	0	0	0	0	0	9	0	1	1	0	0	0	0
37	10	1	0	0	0	0	0	0	0	0	0	0	0	3	0	4	1	0	0	0	0
38	5	0	0	0	0	0	0	0	0	0	0	0	0	3	0	1	0	0	0	0	0
39	4	0	1	0	0	0	0	0	0	0	0	0	0	15	0	2	0	0	0	0	0
40	19	0	1	0	1	0	1	0	0	0	0	0	1	14	0	4	1	0	0	0	0
41	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0
42	4	0	0	0	1	0	0	0	0	0	0	0	0	30	0	1	0	1	0	0	0
43	4	0	0	0	0	0	0	0	0	0	0	0	0	24	0	0	0	0	0	0	0
44	11	0	1	0	0	0	1	0	0	0	0	0	0	21	0	1	0	0	0	3	0
45	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0
46	3	0	0	0	0	0	0	0	0	0	0	0	0	11	0	0	0	0	0	1	0
47	2	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0
48	5	0	0	0	1	0	1	0	0	0	0	0	0	18	0	0	0	1	0	0	0
49	17	0	0	0	3	0	1	0	0	0	0	1	0	49	0	4	1	2	0	2	1
50	44	0	0	0	0	0	1	0	1	0	0	2	0	5	0	4	5	0	0	2	0
51	4	0	0	0	1	0	1	0	1	0	0	9	0	0	0	2	9	7	0	1	0
52	8	0	0	0	1	0	1	0	1	0	0	1	0	0	0	13	4	2	0	1	0
53	11	0	0	0	1	0	1	0	0	0	0	2	0	6	0	3	1	1	0	3	0
54	8	0	0	0	2	0	0	0	0	0	0	0	0	7	0	1	2	1	0	4	0
55	9	0	0	0	0	0	1	0	0	0	0	0	0	5	0	0	0	0	0	2	0
56	21	0	0	0	1	0	2	0	0	0	0	0	0	32	0	1	1	1	0	2	0
57	3	1	1	0	1	0	1	0	0	0	0	0	1	3	0	1	1	2	0	4	0
58	4	0	0	0	1	0	1	0	1	0	0	2	0	32	0	4	2	1	0	6	1
59	3	0	0	0	1	0	0	0	0	0	0	0	0	25	0	1	0	0	0	2	0
60	11	0	0	0	0	0	0	0	0	0	0	0	0	21	0	0	0	0	0	2	0
61	14	0	0	0	1	0	1	0	1	0	0	0	0	32	0	0	0	1	0	1	0
62	7	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0
63	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65	0	0	0	0	1	0	0	0	0	0	0	0	0	2	0	1	0	0	0	0	0
66	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	1	0	0	0
67	4	0	0	0	0	0	0	0	0	0	0	2	0	3	0	0	0	1	0	0	0
68	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0
69	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
70	3	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0

Appendix V. Concentrations of diatoms in number of specimens per millimeter of transect across a microscope slide.

Appendix V. Concentrations of diatoms in number of specimens per millimeter of transect across a microscope slide.

Spl.	frcrot	frvauch	frcap	froth	gomph	gyro	navic	neid	nitz	pin	ropal	rhzeri	stalp	stmin	stniag	syacus	synana	syrump	syuln	syulnc	sycycl
71	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
72	0	0	0	0	0	0	1	0	0	0	0	0	0	7	0	0	0	0	0	0	0
73	1	0	1	1	1	0	1	0	0	0	0	0	0	13	0	1	0	1	0	1	0
74	0	1	0	1	1	0	1	0	0	0	0	0	0	11	0	0	0	2	0	0	0
75	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0
76	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0
77	0	0	0	0	0	0	0	0	0	0	0	0	0	18	0	0	0	0	0	0	0
78	1	0	0	0	0	0	0	0	0	0	0	0	0	4	0	1	0	0	0	0	0
79	10	0	0	0	1	0	1	0	0	0	0	0	0	32	0	2	2	0	0	1	0
80	6	0	0	0	0	0	0	0	0	0	0	0	0	6	0	1	1	1	0	1	0
81	4	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	1	0	0	0
82	1	0	3	0	1	0	0	0	0	0	0	0	0	12	0	0	2	1	0	1	1
83	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1	0	0	0	0
84	3	2	1	0	2	0	1	0	1	0	0	1	0	20	0	2	8	4	0	2	2
85	8	2	4	1	4	0	3	0	1	0	0	0	0	25	0	2	2	3	0	3	0
86	1	0	1	0	1	0	1	0	0	0	0	0	0	8	0	8	4	4	0	1	0
87	17	0	0	0	0	0	0	0	0	0	0	1	0	44	0	2	1	2	0	10	0
88	1	0	0	0	1	0	1	0	0	0	0	2	0	13	0	0	1	0	0	1	0
89	1	0	0	0	0	0	0	0	0	0	0	0	0	29	0	0	0	1	0	0	0
90	0	1	0	4	2	0	3	0	0	0	0	0	0	2	0	0	2	2	1	0	0
91	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
92	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
93	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
94	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
96	3	0	0	0	0	0	0	0	0	0	0	0	0	20	0	1	0	1	0	1	0
97	1	1	1	0	1	0	1	0	1	0	0	2	0	44	0	3	10	3	0	1	0
98	0	0	0	0	1	0	1	0	0	0	0	0	0	4	0	0	1	3	0	0	0
99	1	0	0	0	1	0	0	0	0	0	0	0	0	15	0	1	1	0	0	1	0
100	4	0	0	0	1	0	0	0	0	0	0	1	0	18	0	1	1	0	0	2	0
101	22	1	0	0	1	0	1	0	1	0	0	1	0	30	0	3	2	1	0	1	0
102	1	0	0	0	1	0	1	0	0	0	0	0	0	18	0	0	0	0	0	0	0
103	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
104	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0
105	4	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	0	1	0	1	0

Appendix V. Concentrations of diatoms in number of specimens per millimeter of transect across a microscope slide.

Spl.	frcrot	frvauch	frcap	froth	gomph	gyro	navic	neid	nitz	pin	ropal	rhzeri	stalp	stmin	stniag	syacus	synana	syrump	syuln	syulnc	sycycl
106	15	0	1	0	1	0	0	0	0	0	0	0	0	5	0	1	0	0	0	1	0
107	0	0	1	0	0	0	0	0	0	0	0	0	0	18	0	0	0	0	0	0	0
108	0	0	1	0	0	0	0	0	0	0	0	0	0	25	0	0	0	1	0	0	0
109	3	0	0	0	1	0	2	0	0	0	0	0	0	26	0	3	1	1	0	2	0
110	2	0	0	0	1	0	0	0	0	0	0	1	0	11	0	3	1	1	0	1	0
111	3	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2	0
112	6	1	1	0	0	0	1	0	0	0	0	1	0	21	0	2	4	1	1	3	0
113	3	0	0	0	0	0	1	0	0	0	0	0	1	5	0	1	1	1	0	0	0
114	1	0	0	0	0	0	0	0	0	0	0	0	0	9	0	1	0	0	0	1	0
115	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
116	2	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
117	3	0	0	0	0	0	0	0	0	0	0	1	0	4	0	0	0	0	0	0	0
118	3	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0
119	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
120	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
121	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	1	0
122	3	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	0
123	6	0	0	0	1	0	0	0	0	0	0	0	0	2	0	1	1	0	0	0	0
124	9	0	0	0	0	0	0	0	0	0	0	4	0	7	0	1	1	1	0	4	0
125	6	2	1	0	1	0	1	0	1	0	0	0	0	1	0	1	2	0	0	0	3
126	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
127	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
128	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
129	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0
130	3	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0
131	3	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	0
132	2	0	0	0	1	0	0	0	0	0	0	0	0	3	0	0	0	0	0	1	0
133	11	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	1	0	0	3	0
134	18	0	0	0	0	0	0	0	0	0	0	0	2	7	0	0	0	0	0	1	0
135	8	0	0	0	0	0	0	0	0	0	0	0	0	3	0	1	0	0	0	1	0
136	5	0	0	0	0	0	1	0	0	0	0	0	0	8	0	1	0	0	1	1	0
137	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0
138	1	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0
139	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
140	7	0	0	0	0	0	1	0	0	0	0	0	1	2	0	0	0	0	0	0	0

Appendix V. Concentrations of diatoms in number of specimens per millimeter of transect across a microscope slide.

Appendix V. Concentrations of diatoms in number of specimens per millimeter of transect across a microscope slide.

Spl.	frcrot	frvauch	frcap	froth	gomph	gyro	navic	neid	nitz	pin	ropal	rhzeri	stalp	stmin	stniag	syacus	synana	syrump	syuln	syulnc	sycycl
141	15	0	0	0	1	0	1	0	0	0	0	0	1	9	0	0	0	0	1	3	1
142	4	0	0	0	1	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0
143	5	0	0	0	1	0	1	0	0	0	0	0	0	11	0	9	1	0	1	0	0
144	4	0	0	0	0	0	0	0	0	0	0	0	0	13	0	8	0	1	0	3	0
145	12	0	1	0	2	0	1	0	0	0	0	0	0	17	0	0	1	2	0	0	0
146	26	0	0	0	1	0	1	0	0	0	0	0	0	13	0	2	1	1	0	0	0
147	21	0	0	1	1	0	1	0	0	0	0	0	0	21	0	1	1	1	1	0	0
148	7	0	0	0	0	0	1	0	0	0	0	0	0	43	0	0	1	1	0	1	2
149	1	2	0	0	2	0	2	0	1	0	0	0	0	56	0	4	4	11	1	0	0
150	4	4	1	0	2	0	1	0	2	0	0	0	0	23	0	3	2	8	1	0	0
151	1	0	0	0	0	0	0	0	0	0	0	0	0	9	0	1	0	0	0	0	0
152	10	0	1	0	1	0	1	0	0	0	0	0	0	20	0	2	0	0	1	1	1
153	3	0	0	0	0	0	0	0	0	0	0	0	0	9	0	1	1	0	0	0	0
154	9	0	1	0	1	0	0	0	0	0	0	0	0	8	0	0	1	0	0	0	1
155	14	0	0	0	1	0	0	0	0	0	0	0	0	9	0	0	0	0	0	1	0
156	8	0	0	0	0	0	0	0	0	0	0	0	0	6	0	1	0	0	0	0	0
157	14	0	0	0	0	0	0	0	0	0	0	0	0	13	0	1	1	0	0	0	1
158	21	0	4	0	1	0	2	0	1	0	0	0	0	85	0	0	3	1	0	0	1
159	1	0	1	0	1	0	1	0	0	0	0	0	0	40	0	1	0	0	0	0	1
160	3	0	0	0	1	0	0	0	0	0	0	0	0	19	0	0	0	0	0	0	0
161	19	1	0	0	1	0	2	0	0	0	0	0	0	79	0	4	4	1	2	0	1
162	25	0	0	0	1	0	1	0	0	0	0	0	0	61	0	3	1	3	1	1	0
163	4	0	0	0	1	0	1	0	0	0	0	0	1	3	0	1	0	0	0	0	0
164	21	0	1	0	2	0	1	0	0	0	0	0	7	73	0	2	0	0	1	3	0
165	8	0	0	0	0	0	0	0	0	0	0	0	1	7	0	0	0	0	1	1	0
166	5	0	1	0	1	0	1	0	0	0	0	0	2	18	0	0	0	0	1	1	0
167	6	0	1	0	0	0	0	0	0	0	0	0	1	2	0	1	0	0	1	2	0
168	2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1	0
169	4	0	0	0	1	0	0	0	0	0	0	0	2	12	0	0	0	0	1	1	0
170	4	0	0	0	0	0	0	0	0	0	0	0	1	6	0	0	0	0	0	0	0
171	2	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	1	1	0
172	2	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	1	0
173	19	0	0	0	3	0	1	0	0	0	0	0	5	31	0	0	0	0	1	2	0
174	14	1	1	0	2	0	1	0	0	0	0	1	4	14	0	1	0	0	1	1	0
175	4	0	1	0	1	0	1	0	0	0	0	1	2	15	0	0	0	0	0	1	0

Appendix V. Concentrations of diatoms in number of specimens per millimeter of transect across a microscope slide.

Spl.	frcrot	frvauch	frcap	froth	gomph	gyro	navic	neid	nitz	pin	ropal	rhzeri	stalp	stmin	stniag	syacus	synana	syrump	syuln	syulnc	sycycl
176	10	0	0	1	0	0	0	0	0	0	0	1	2	20	0	1	1	0	0	1	0
177	11	0	0	0	1	0	0	0	0	0	0	1	0	46	0	2	1	1	0	3	0
178	9	0	0	0	0	0	1	0	0	0	0	1	1	24	0	1	1	0	0	2	0
179	24	0	0	0	0	0	1	0	1	0	0	0	2	3	0	0	1	0	0	2	0
180	8	0	1	0	0	0	1	0	0	0	0	0	3	9	0	2	1	0	0	1	0
181	7	0	1	0	1	0	1	0	1	0	0	0	2	26	0	0	0	1	0	2	0
182	4	0	0	0	0	0	0	0	0	0	0	0	0	14	0	0	0	0	0	1	0
183	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
184	5	0	0	0	0	0	1	0	0	0	0	0	2	6	0	1	1	0	0	0	0
185	12	1	2	0	1	0	1	0	0	0	0	0	1	10	0	1	0	1	1	1	1
186	6	0	1	0	1	0	0	0	0	0	0	0	1	8	0	1	1	1	0	0	1
187	6	0	1	0	0	0	1	0	0	0	0	0	0	18	0	0	0	0	0	1	0
188	4	0	0	0	1	0	0	0	0	0	0	1	0	17	0	2	0	0	0	1	0
189	31	0	0	0	0	0	1	0	0	0	0	0	0	26	0	1	0	1	0	1	0
190	9	0	0	0	0	0	0	0	0	0	0	2	0	3	0	1	0	0	0	1	0
191	12	0	0	0	0	0	1	0	0	0	0	1	0	15	0	1	3	1	0	2	1
192	6	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	1	0	0	1	0
193	4	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
194	4	0	0	0	0	0	1	0	0	0	0	0	0	2	0	0	0	0	0	0	0
195	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
196	1	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0
197	3	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0
198	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
199	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
200	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
201	1	0	0	0	0	0	0	0	0	0	0	0	0	7	0	1	0	0	0	0	0
202	12	0	0	0	1	0	0	0	0	0	0	1	0	7	0	1	0	1	0	2	0
203	2	0	1	0	0	0	1	0	0	0	0	0	0	4	0	1	3	1	0	0	0
204	15	0	0	0	1	0	1	0	0	0	0	0	0	10	0	1	1	0	1	1	0
205	4	0	1	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0
206	11	1	1	1	1	0	2	0	0	0	0	0	0	31	0	1	3	2	2	1	1
207	0	0	0	0	0	0	1	0	0	0	0	0	0	17	0	0	0	0	0	0	0
208	0	0	1	0	1	0	1	0	0	0	0	0	0	15	0	0	2	1	0	0	0
209	0	0	0	0	0	0	0	0	0	0	0	0	0	11	0	0	1	1	0	0	0
210	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix V. Concentrations of diatoms in number of specimens per millimeter of transect across a microscope slide.

Appendix V. Concentrations of diatoms in number of specimens per millimeter of transect across a microscope slide.

Spl.	frcrot	frvauch	frcap	froth	gomph	gyro	navic	neid	nitz	pin	ropal	rhzeri	stalp	stmin	stniag	syacus	synana	syrump	syuln	syulnc	sycycl
211	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
212	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
213	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
214	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
215	2	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
216	9	0	1	0	0	0	1	0	0	0	0	0	0	9	0	1	0	0	0	1	0
217	6	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
218	12	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0
219	14	1	1	0	1	0	1	0	0	0	0	1	0	1	1	0	0	0	0	0	0
220	5	1	0	0	1	0	1	0	0	0	0	0	0	1	1	0	0	2	0	0	0
221	12	0	2	0	1	0	1	0	1	0	0	0	0	21	2	1	1	0	0	0	0
222	11	0	2	0	1	0	1	0	0	0	0	0	0	3	1	2	1	1	1	0	0
223	11	1	6	1	1	0	1	0	0	0	0	0	0	0	0	1	1	1	1	0	1
224	7	1	2	0	1	0	1	0	0	0	0	0	0	1	0	1	1	1	0	0	0
225	21	0	2	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	0	0	0
226	9	0	8	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
227	15	1	1	0	1	0	1	0	0	0	0	0	0	0	1	0	1	1	0	0	0
228	11	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	1	0	0	0	0
229	15	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0
230	12	1	1	2	1	0	1	0	0	0	0	0	0	9	0	1	1	0	1	0	1
231	38	1	0	0	1	0	1	0	1	0	0	0	0	0	0	2	14	1	1	0	0
232	27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0
233	7	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
234	9	0	0	0	1	0	1	0	0	0	0	1	0	0	3	0	1	2	0	0	0
235	8	1	1	0	1	0	1	0	0	0	0	0	0	0	3	1	1	2	0	0	0
236	10	1	0	0	1	0	0	0	0	0	0	0	0	0	6	0	1	1	0	0	0
237	6	0	1	0	0	0	1	0	0	0	0	0	0	7	1	0	0	1	0	0	0
238	5	0	0	0	0	0	1	0	0	0	0	0	0	5	2	0	0	0	0	0	0
239	3	0	0	0	1	0	1	0	1	0	0	0	0	14	0	5	2	3	1	1	0
240	11	1	1	0	1	0	1	0	0	0	0	0	0	1	0	1	0	1	0	0	0
241	14	0	1	0	1	0	1	0	0	0	0	0	0	9	0	1	1	1	0	0	0
242	13	0	1	0	1	0	0	0	0	0	0	0	0	5	0	1	2	1	0	0	0
243	17	2	1	0	0	0	2	0	1	0	0	0	0	98	1	2	2	2	0	0	0
244	20	0	0	0	1	0	1	0	0	0	0	0	1	7	0	0	1	0	0	0	0
245	20	1	1	1	2	0	2	0	1	0	0	0	2	0	0	0	0	1	1	0	0

Appendix V. Concentrations of diatoms in number of specimens per millimeter of transect across a microscope slide.

Spl.	frcrot	frvauch	frcap	froth	gomph	gyro	navic	neid	nitz	pin	ropal	rhzeri	stalp	stmin	stniag	syacus	synana	syrump	syuln	syulnc	sycycl
246	6	1	0	0	1	0	1	0	0	0	0	0	1	0	0	0	0	1	0	0	0
247	6	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0
248	16	0	0	0	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0
249	21	0	0	0	0	0	1	0	1	0	0	0	1	0	0	0	0	1	0	0	0
250	16	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0
251	14	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
252	9	0	1	0	1	0	1	0	0	0	0	0	0	1	0	1	0	1	0	0	0
253	31	0	0	0	1	0	0	0	1	0	0	0	4	17	0	1	1	0	0	1	1
254	17	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0
255	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
256	9	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
257	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0
258	26	1	1	0	1	0	2	0	1	0	0	0	2	10	0	1	0	1	1	0	0
259	11	1	1	1	1	0	1	0	0	0	0	0	1	46	0	1	0	0	1	0	0
260	11	0	0	1	1	0	1	0	1	0	0	0	0	7	0	4	1	0	0	0	0
261	2	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
262	9	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
263	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
264	11	0	2	0	2	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
265	9	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0
266	13	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0
267	1	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
268	6	1	0	0	0	0	1	0	0	0	0	0	0	0	3	0	0	0	0	0	0
269	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
270	4	0	0	0	1	0	1	0	1	0	0	1	1	4	0	1	0	0	1	0	0
271	8	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	1	0	1	0
272	9	1	0	0	1	0	0	0	0	0	0	0	0	0	2	1	0	1	0	0	0
273	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
274	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
275	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
276	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
277	1	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0
278	2	0	0	0	0	0	1	0	0	0	0	0	1	0	2	0	0	0	0	0	0
279	2	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0
280	4	0	0	0	1	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0

Appendix V. Concentrations of diatoms in number of specimens

Appendix V. Concentrations of diatoms in number of specimens per millimeter of transect across a microscope slide.

Spl.	frcrot	frvauch	frcap	froth	gomph	gyro	navic	neid	nitz	pin	ropal	rhzeri	stalp	stmin	stniag	syacus	synana	syrump	syuln	syulnc	sycycl
281	9	0	0	0	1	0	1	0	0	0	0	0	1	0	3	0	0	0	0	0	0
282	19	1	0	0	1	0	1	0	0	0	0	0	1	0	2	0	0	0	0	0	0
283	18	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0
284	6	0	0	0	0	0	0	0	0	0	0	0	0	7	1	1	0	0	0	0	0
285	8	0	0	0	0	0	1	0	0	0	0	2	1	5	2	0	0	0	0	0	0
286	14	0	0	1	0	0	1	0	0	0	0	2	1	7	3	0	0	1	0	0	0
287	13	0	0	1	1	0	1	0	1	0	0	0	0	2	3	1	0	1	0	0	0
288	33	0	0	0	1	0	1	0	0	0	0	0	0	1	2	0	0	0	0	0	1

Appendix V. Concentrations of diatoms in number of specimens per millimeter of transect across a microscope slide.

Spl.	sypara	surir	stauro	tabflo	ch-10	phyto	cyst	scale	spic
1	0	0	0	1	0	0	1	3	0
2	0	0	0	2	0	0	2	4	0
3	0	0	0	1	0	0	2	2	0
4	0	0	0	2	0	0	3	2	0
5	0	0	0	1	0	0	1	0	0
6	0	0	0	2	0	0	2	2	0
7	0	0	0	2	0	1	3	3	0
8	0	0	0	3	0	0	2	2	0
9	0	0	0	3	0	1	3	2	0
10	0	0	0	3	0	1	3	1	0
11	0	0	0	2	0	0	1	0	0
12	0	0	0	3	0	1	2	1	0
13	0	0	0	10	0	1	3	1	0
14	0	0	0	13	0	1	1	1	0
15	0	0	0	8	0	1	3	1	0
16	0	0	0	4	0	2	5	3	0
17	0	0	0	6	0	1	4	1	0
18	0	0	0	4	0	2	3	1	0
19	0	0	0	5	0	1	4	1	0
20	0	0	0	12	0	1	2	1	0
21	0	0	0	4	0	1	2	1	0
22	0	0	0	10	0	2	3	1	0
23	0	0	0	3	0	2	15	3	0
24	0	0	0	1	0	1	5	1	0
25	0	0	0	3	0	1	4	1	0
26	0	0	0	3	0	1	6	1	0
27	0	0	0	2	0	1	2	0	0
28	0	0	0	2	0	1	3	0	0
29	0	0	0	2	0	1	4	0	0
30	0	0	0	4	1	1	7	1	0
31	0	0	0	3	0	0	3	1	0
32	0	0	0	5	0	1	7	2	0
33	0	0	0	4	1	1	6	2	0
34	0	0	0	5	1	0	3	3	0
35	0	0	0	6	1	0	4	8	0

Appendix V. Concentrations of diatoms in number of specimens per millimeter of transect across a microscope slide.

Appendix V. Concentrations of diatoms in number of specimens per millimeter of transect across a microscope slide.

Spl.	sypara	surir	stauro	tabflo	ch-10	phyto	cyst	scale	spic
36	0	0	0	8	1	0	2	1	0
37	0	0	0	1	1	0	2	1	0
38	0	0	0	1	0	0	3	1	0
39	0	0	0	0	1	0	3	2	0
40	0	0	0	0	2	1	3	4	0
41	0	0	0	0	0	0	4	4	0
42	0	0	0	0	1	0	4	1	0
43	0	0	0	0	1	0	2	2	0
44	0	0	0	0	1	1	6	4	0
45	0	0	0	0	3	0	5	0	0
46	0	0	0	0	2	1	4	0	0
47	0	0	0	0	1	0	4	1	0
48	0	0	0	0	3	0	8	4	0
49	0	1	1	0	5	0	14	22	0
50	0	0	0	0	5	0	10	13	0
51	0	0	0	0	7	1	18	15	0
52	0	0	0	0	5	1	9	32	0
53	0	0	0	0	2	0	5	17	0
54	0	0	0	0	1	0	5	12	0
55	1	0	0	0	2	0	9	6	0
56	1	0	0	0	2	1	8	4	0
57	0	0	0	0	2	0	12	6	0
58	0	0	0	0	1	0	8	11	0
59	0	0	0	0	2	0	9	10	0
60	0	0	0	0	1	0	8	8	0
61	0	0	0	0	1	0	4	0	0
62	0	0	0	0	1	0	4	1	0
63	0	0	0	0	1	0	1	1	0
64	0	0	0	0	1	0	2	1	0
65	1	0	0	0	1	0	0	1	0
66	0	0	0	0	2	0	9	1	0
67	1	0	0	0	2	0	3	1	0
68	0	0	0	0	1	0	2	1	0
69	0	0	0	0	2	0	3	0	0
70	0	0	0	0	2	0	1	1	0

Appendix V. Concentrations of diatoms in number of specimens per millimeter of transect across a microscope slide.

Spl.	sypara	surir	stauro	tabflo	ch-10	phyto	cyst	scale	spic
71	0	0	0	0	1	0	1	0	0
72	0	0	0	0	1	0	2	1	0
73	0	0	0	0	1	0	3	1	0
74	0	0	0	0	3	0	1	3	0
75	0	0	0	0	2	0	1	0	0
76	0	0	0	0	3	0	5	0	0
77	0	0	0	0	2	0	3	0	0
78	0	0	0	2	2	0	3	0	0
79	0	0	0	2	1	0	3	2	0
80	0	0	0	0	1	0	1	3	0
81	0	0	0	0	1	0	2	2	0
82	0	0	0	0	2	1	9	2	0
83	0	0	0	0	1	0	2	1	0
84	0	0	0	0	2	1	9	13	0
85	0	0	0	0	3	1	10	13	0
86	0	0	0	0	1	1	14	18	0
87	0	0	0	0	3	1	14	10	0
88	0	0	0	0	2	0	6	3	0
89	0	0	0	0	0	0	3	1	0
90	0	0	0	0	3	1	25	2	0
91	0	0	0	0	1	0	1	0	0
92	0	0	0	0	2	0	0	0	0
93	0	0	0	0	3	0	1	0	0
94	0	0	0	0	2	0	1	0	0
95	0	0	0	0	2	0	2	0	0
96	0	0	0	0	1	0	3	1	0
97	0	0	0	0	1	0	4	6	0
98	0	0	0	0	1	0	2	2	0
99	0	0	0	0	1	0	4	4	0
100	0	0	0	0	2	0	6	7	0
101	0	0	0	0	4	2	17	29	0
102	0	0	0	0	1	0	4	4	0
103	0	0	0	0	1	0	6	0	0
104	0	0	0	0	1	0	2	1	0
105	0	0	0	0	0	0	4	4	0

Appendix V. Concentrations of diatoms in number of specimens per millimeter of transect across a microscope slide

Appendix V. Concentrations of diatoms in number of specimens per millimeter of transect across a microscope slide.

Spl.	sypara	surir	stauro	tabflo	ch-10	phyto	cyst	scale	spic
106	0	0	0	0	1	0	2	4	0
107	0	0	0	0	0	0	3	1	0
108	0	0	0	0	0	0	3	1	0
109	0	0	0	0	2	0	10	3	0
110	0	0	0	0	1	0	3	7	0
111	0	0	0	0	1	0	5	3	0
112	0	0	0	0	1	3	4	14	0
113	0	0	0	0	1	0	6	10	0
114	0	0	0	0	0	0	3	3	0
115	0	0	0	0	1	0	4	2	0
116	0	0	0	0	1	0	3	4	0
117	0	0	0	0	1	0	3	3	0
118	0	0	0	0	1	0	3	3	0
119	0	0	0	0	1	0	3	1	0
120	0	0	0	0	2	0	2	0	0
121	0	0	0	0	1	0	3	1	0
122	0	0	0	0	2	0	4	3	0
123	0	0	0	0	1	0	3	9	0
124	0	0	0	0	1	0	2	8	0
125	0	0	0	0	0	0	8	9	0
126	0	0	0	0	1	0	2	0	0
127	0	0	0	0	1	0	1	0	0
128	0	0	0	0	1	0	1	0	0
129	0	0	0	0	1	0	3	0	0
130	0	0	0	0	1	0	1	3	0
131	0	0	0	0	1	0	3	5	0
132	0	0	0	0	1	0	4	3	0
133	0	0	0	0	0	0	6	7	0
134	0	0	0	0	0	0	3	2	0
135	0	0	0	0	1	0	2	3	0
136	0	0	0	0	1	0	4	5	0
137	0	0	0	0	1	0	3	1	0
138	0	0	0	0	0	0	4	1	0
139	0	0	0	1	0	0	2	0	0
140	0	0	0	6	2	0	3	1	0

Appendix V. Concentrations of diatoms in number of specimens per millimeter of transect across a microscope slide.

Spl.	sypara	surir	stauro	tabflo	ch-10	phyto	cyst	scale	spic
141	0	0	0	0	1	0	7	1	0
142	0	0	0	0	1	0	4	1	0
143	0	0	0	0	1	0	5	4	0
144	0	0	0	0	0	0	2	2	0
145	0	0	0	0	1	0	6	3	0
146	0	0	0	1	0	0	6	3	0
147	0	0	0	1	1	0	4	4	0
148	0	0	0	4	1	0	4	1	0
149	0	0	0	0	1	1	12	1	0
150	0	0	0	0	1	0	5	1	0
151	0	0	0	1	0	0	2	1	0
152	0	0	0	3	1	0	3	2	0
153	0	0	0	2	1	0	5	7	0
154	0	0	0	1	1	0	5	6	0
155	0	0	0	0	0	0	2	3	0
156	0	0	0	0	0	0	2	2	0
157	0	0	0	0	0	0	4	2	0
158	0	0	0	0	2	1	10	3	0
159	0	0	0	0	2	1	9	3	0
160	0	0	0	0	1	0	5	0	0
161	0	0	0	1	5	1	5	5	0
162	0	0	0	1	2	1	6	2	0
163	0	0	0	1	2	0	6	2	0
164	0	0	0	1	4	3	11	6	0
165	0	0	0	1	0	0	3	5	0
166	0	0	0	1	1	0	6	3	0
167	0	0	0	1	1	0	6	0	0
168	0	0	0	0	1	0	2	1	0
169	0	0	0	0	1	0	3	4	0
170	0	0	0	0	1	0	2	2	0
171	0	0	0	0	1	0	3	1	0
172	0	0	0	0	1	0	2	1	0
173	0	0	0	0	5	1	7	9	0
174	1	0	0	0	2	1	5	14	0
175	0	0	0	0	1	0	4	7	0

Appendix V. Concentrations of diatoms in number of specimens per millimeter of transect across a microscope slide.

Spl. sypara surir stauro tabflo ch-10 phyto

Appendix V. Concentrations of diatoms in number of specimens per millimeter of transect across a microscope slide.

Spl.	sypara	surir	stauro	tabflo	ch-10	phyto	cyst	scale	spic
176	0	0	0	0	1	0	5	9	0
177	0	0	0	0	1	1	2	9	0
178	0	0	0	0	2	0	4	9	0
179	0	0	0	3	1	0	9	16	0
180	0	0	0	1	1	0	3	5	0
181	0	1	0	2	2	1	3	1	0
182	0	0	0	3	0	0	1	2	0
183	0	0	0	0	2	1	1	1	0
184	0	0	0	0	2	1	4	4	0
185	0	0	0	0	3	0	4	17	0
186	0	0	0	0	1	0	2	7	0
187	0	0	0	0	1	0	4	5	0
188	0	0	0	0	1	0	7	9	0
189	0	0	0	2	1	0	9	7	0
190	0	0	0	1	1	0	3	6	0
191	0	0	0	1	1	0	3	3	0
192	0	0	0	3	1	0	3	1	0
193	0	0	0	0	1	0	2	2	0
194	0	0	0	0	2	0	3	3	0
195	0	0	0	0	1	0	2	1	0
196	0	0	0	0	1	0	2	1	0
197	0	0	0	0	1	0	3	2	0
198	0	0	0	0	1	0	1	1	0
199	0	0	0	0	2	0	1	0	0
200	0	0	0	0	3	0	3	2	0
201	0	0	0	0	2	0	2	4	0
202	0	0	0	0	3	0	5	9	0
203	0	0	0	0	2	0	4	13	0
204	0	0	0	0	1	0	6	11	0
205	0	0	0	0	1	1	4	3	0
206	0	0	0	0	5	1	7	11	0
207	0	0	0	0	1	0	4	1	0
208	0	0	0	0	2	0	6	3	0
209	0	0	0	0	2	0	6	2	0
210	0	0	0	2	1	0	1	0	0

Appendix V. Concentrations of diatoms in number of specimens per millimeter of transect across a microscope slide.

Spl.	sypara	surir	stauro	tabflo	ch-10	phyto	cyst	scale	spic
211	0	0	0	0	1	0	3	1	0
212	0	0	0	0	1	0	3	0	0
213	0	0	0	0	2	0	2	0	0
214	0	0	0	0	2	0	3	0	0
215	0	0	0	0	2	0	2	1	0
216	0	0	0	0	2	0	6	6	0
217	0	0	0	0	1	0	4	1	0
218	0	0	0	0	1	0	6	7	0
219	0	0	0	0	1	0	4	3	0
220	0	0	0	1	1	0	4	2	0
221	0	0	0	0	1	0	2	1	0
222	0	0	0	1	0	0	3	2	0
223	0	0	0	3	3	0	9	6	0
224	0	0	0	2	1	0	4	9	0
225	0	0	0	1	1	1	6	5	0
226	0	0	0	2	1	0	3	3	0
227	0	0	0	1	1	0	3	3	0
228	0	0	0	4	1	0	2	3	0
229	0	0	0	1	1	0	1	2	0
230	0	0	0	1	1	1	5	2	0
231	0	0	0	0	1	0	4	6	0
232	0	0	0	0	1	0	1	2	0
233	0	0	0	3	2	0	6	2	0
234	0	0	0	0	2	0	6	8	0
235	0	0	0	0	1	0	4	4	0
236	0	0	0	0	1	0	2	5	0
237	0	0	0	0	1	0	5	9	0
238	0	0	0	0	1	0	5	9	0
239	0	0	0	0	1	0	6	15	0
240	0	0	0	0	1	0	5	2	0
241	0	0	0	0	1	0	4	7	0
242	0	0	0	0	1	0	4	3	0
243	0	0	0	0	1	0	4	8	0
244	0	0	0	0	1	0	2	1	0
245	0	0	0	0	2	1	8	10	0

Appendix V. Concentrations of diatoms in number of specimens per millimeter of transect across a microscope slide.

Spl.	sypara	surir	stauro	tabflo	ch-10	phyto	cyst	scale	spic
246	0	0	0	0	1	0	4	4	0
247	0	0	0	0	1	0	1	26	0
248	0	0	0	1	1	0	3	2	0
249	0	0	0	2	1	0	4	4	0
250	0	0	0	2	0	0	4	4	0
251	0	0	0	1	1	0	3	1	0
252	0	0	0	1	1	0	4	2	0
253	0	0	0	1	0	0	4	3	0
254	0	0	0	2	1	0	2	2	0
255	0	0	0	0	0	0	1	1	0
256	0	0	0	0	1	0	3	0	0
257	0	0	0	0	1	0	1	2	0
258	0	0	0	0	3	1	7	6	0
259	0	0	0	0	2	0	4	3	0
260	0	0	0	0	2	1	7	14	0
261	0	0	0	0	2	0	4	0	0
262	0	0	0	0	1	0	4	1	0
263	0	0	0	0	1	0	2	1	0
264	0	0	0	0	2	1	6	2	0
265	0	0	0	0	1	0	3	7	0
266	0	0	0	0	0	0	2	6	0
267	0	0	0	0	1	0	6	1	0
268	0	0	0	0	1	0	7	2	0
269	0	0	0	0	0	0	2	14	0
270	0	0	0	0	2	0	6	9	0
271	0	0	0	0	1	0	3	11	0
272	0	0	0	0	1	0	3	4	0
273	0	0	0	0	1	0	5	1	0
274	0	0	0	0	0	0	3	2	0
275	0	0	0	0	1	0	3	2	0
276	0	0	0	0	1	0	3	3	0
277	0	0	0	0	2	0	6	3	0
278	0	0	0	0	1	0	4	2	0
279	0	0	0	0	1	0	2	2	0
280	0	0	0	0	1	0	3	3	0

Appendix V. Concentrations of diatoms in number of specimens per millimeter of transect across a microscope slide.

Spl.	sypara	surir	stauro	tabflo	ch-10	phyto	cyst	scale	spic
281	0	0	0	0	1	0	6	10	0
282	0	0	0	0	1	1	7	8	0
283	0	0	0	0	1	0	4	4	0
284	0	0	0	0	2	0	3	3	0
285	1	0	0	0	1	0	3	13	0
286	0	0	0	0	2	1	4	6	0
287	0	0	0	0	3	0	10	9	0
288	0	0	0	0	3	0	5	15	0